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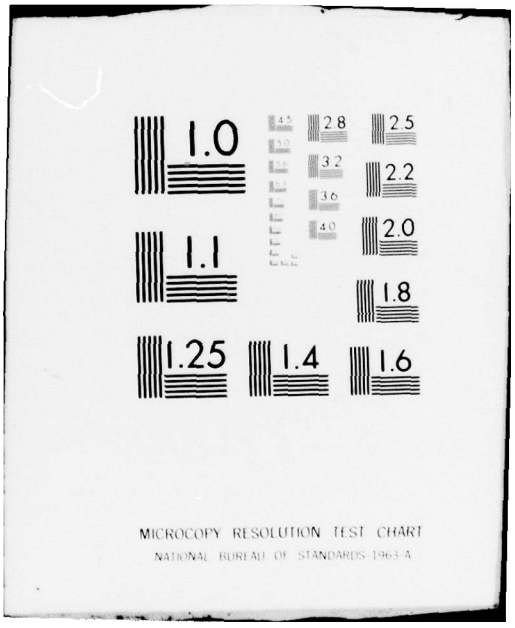
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DELAWARE RIVER BASIN
TAMARACK CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

BIG BASS LAKE DAM

NDI ID NO. PA-00368
DER ID NO. 35-126

LEVEL

BIG BASS LAKE, INC.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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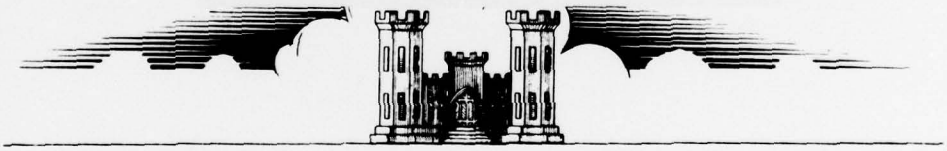

Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

ORIGINAL CONTAINS COLOR PLATES: ALL DDC
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DEPARTMENT OF THE ARMY
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DELAWARE RIVER BASIN,

TAMARACK CREEK, LACKAWANNA COUNTY,

PENNSYLVANIA.

(6) National Dam Inspection Program.

BIG BASS LAKE DAM

(NDI ID Number PA-00368
DER ID Number 35-126)

~~BIG BASS LAKE, INC.~~

PHASE I INSPECTION REPORT,

NATIONAL DAM INSPECTION PROGRAM

(10) Frederick/Futchko/

Prepared by

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Consulting Engineers
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Harrisburg, Pennsylvania 17105

For

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

DELAWARE RIVER BASIN

TAMARACK CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

BIG BASS LAKE DAM

NDI ID No. PA-00368
DER ID No. 35-126

BIG BASS LAKE, INC.

NATIONAL DAM INSPECTION PROGRAM

JULY 1979

CONTENTS

PLATES

APPENDICES

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Big Bass Lake NDI ID No. PA-00368/DER ID No. 35-126
Owner:	Big Bass Lake, Inc.
State Located:	Pennsylvania
County Located:	Lackawanna
Stream:	Tamarack Creek
Date of Inspection:	15 June 1979
Inspection Team:	Gannett Fleming Corddry and Carpenter, Inc. Consulting Engineers P.O. Box 1963 Harrisburg, Pennsylvania 17105

Based on visual inspection, available records, calculations, past operational performance, and according to criteria established for these studies, Big Bass Lake Dam is judged to be unsafe, nonemergency, because the spillway capacity is rated as seriously inadequate. The spillway can only pass 10 percent of the Probable Maximum Flood (PMF) without overtopping of the low area by the main spillway walls. It is estimated that the main spillway weir will fail at about the 20 percent PMF flood. The Owner has placed flashboards along the spillway crest, which reduces the spillway capacity significantly. The effects of the flashboards are included in the spillway capacities above. It is estimated that the flashboards will not function properly. The resulting outflows from the failure of the main spillway of Big Bass Lake Dam would result in the loss of life downstream. As a whole, the dam is judged to be in good condition.

The stability of the main spillway is considered marginal for the normal operating condition. The stability

is significantly worse for higher pool levels. There is no evidence of significant problems threatening the embankment.

If the flashboards were removed, the dam could pass 23 percent of the PMF without overtopping of the low area by the main spillway walls. The removal of the flashboards would significantly improve the stability of the main spillway.

The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Remove the flashboards from the main spillway crest.

(2) Engage the services of a professional engineer experienced in the design and construction of dams to perform the following studies: a study to more accurately determine the spillway capacity required at the dam and the measures required to make the spillway hydraulically adequate, and a study to determine the structural integrity of the main spillway and the measures required to make the spillway structurally adequate. As a minimum, the studies will require an exploration program to determine the engineering properties of the main spillway foundation soils. Take appropriate action as necessary.

(3) Provide protection against ice damage at the outlet works gate.

(4) Raise the embankment to its design elevation.

(5) As part of the regular maintenance program, remove trees close to the main spillway weir, fill the burrowing animal and stump holes, and monitor the dry seepage path by the right abutment of the embankment. If seepage is noted, have it evaluated by a professional engineer, as noted above. Also, as part of this program, continue observing the upstream slope of the embankment, especially after floods. If erosion is noted, continue the present practice of effecting repairs immediately.

In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Big Bass Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Big Bass Lake Dam.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

(5) Institute a maintenance program to properly maintain all features of the dam.

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.

FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 7 August 1979

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

DATE: 23 August 1979

BIG BASS LAKE DAM

Overview

DELAWARE RIVER BASIN

TAMARACK CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

BIG BASS LAKE DAM

NDI ID No. PA-00368
DER ID No. 35-126

BIG BASS LAKE, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JULY 1979

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. The essential features of Big Bass Lake Dam are a masonry gravity main spillway across the natural stream, an auxiliary spillway in an earthen cut, an embankment in a natural saddle, and an outlet works. The masonry gravity spillway extends across the stream and into the stream banks on each side. The main spillway crest is 58.5 feet long and is 8.0 feet above streambed. The tops of the masonry walls on each side of the crest are 2.1 feet

[cont'd on p. iv]

above the crest. One-foot high flashboards extend along the crest. The auxiliary spillway is in an earthen cut immediately to the left of the main spillway. The auxiliary spillway has an earthen control section. The control section is 29.0 feet long and is 1.6 feet above the main spillway crest. The exit channel of the auxiliary spillway extends to the natural stream.

The embankment is situated in a natural saddle about 600 feet to the left of the auxiliary spillway. The embankment is about 400 feet long and has a height of 8.0 feet of maximum section.

The outlet works is located in the right wall of the main spillway. It consists of a sluice gate and an 18-inch corrugated metal pipe which has its outfall beneath the main spillway crest.

The various features of the dam are shown on the Plates at the end of the report and on the Photographs in Appendix D.

b. Location. The dam is located on Tamarack Creek, approximately 1.9 miles west of Gouldsboro, Pennsylvania. Big Bass Lake Dam is shown on USGS Quadrangle, Sterling, Pennsylvania, with coordinates N41°15'05" and W75°29'45" in Lackawanna County, Pennsylvania. A location map is shown on Plate 1.

c. Size Classification. Small (12 feet high, 455 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Big Bass Lake Dam (Paragraph 3.1e and 5.1c(5)).

e. Ownership. Big Bass Lake, Inc., Gouldsboro, Pennsylvania.

f. Purpose of Dam. Recreation.

g. Design and Construction History. Big Bass Lake Dam was designed by John E. Hennemuth, Consulting Engineer of Scranton, for Mr. Adolph Sheffick. The dam was designed in 1951 and 1952. The dam was completed in July, 1957. It was built by Mr. Sheffick, with locally hired labor. It was originally used for fishing.

The dam was acquired by the present Owner in 1971. He drew down the lake at that time to construct a beach on

the upstream slope of the embankment. The embankment slopes were regraded at that time.

Flashboards were placed on the main spillway crest in 1972. Ever since its original construction, nearby residents have been concerned about the dam. They objected to the flashboards, the placement of which was approved by the Commonwealth. To placate their objections, an auxiliary spillway was constructed in 1973.

h. Normal Operational Procedure. The pool is maintained at the top of the flashboards on the spillway crest with excess inflow discharging over the spillway.

1.3 Pertinent Data.

a.	Drainage Area. (square miles)	1.8
b.	Discharge at Damsite. (cfs.)	
	Maximum known flood at damsite	610
	Outlet works at maximum pool elevation	30
	Spillway capacity at maximum pool elevation:	
	Existing conditions assuming flashboards remain intact.	
	(1) Pool at top of spillway walls, El. 1841.5.	
	Main Spillway	180
	Auxiliary Spillway	30
	Total	210
	(2) Pool at top of existing embankment, El. 1841.9.	
	Main spillway	310
	Auxiliary spillway	100
	Total	410
	(3) Pool at design top of embankment, El. 1842.5.	
	Main spillway	520
	Auxiliary spillway	290
	Total	810

c. Elevation. (feet above msl.)

Top of embankment (design)	1842.5
Maximum pool	1842.5
Top of embankment (existing)	1841.9
Top of spillway walls	1841.5
Top of flashboards (normal pool)	1840.5

Spillway crest	
Design	1838.4
Existing	1839.4
Auxiliary spillway crest	1841.0
Upstream invert outlet works	1832.9
Downstream invert outlet works	1832.9
Streambed at toe of main spillway	1830.4
Natural ground at downstream toe of embankment	1834.4

d. Reservoir Length. (miles)

Main spillway crest (existing)	0.5
Normal pool	0.6
Maximum pool	0.7

e. Storage. (Acre-feet)

Main spillway crest (existing)	188
Normal pool	277
Maximum pool	455

f. Reservoir Surface. (Acres)

Main spillway crest (existing)	79
Normal pool	84
Maximum pool	94

g. Dam. (embankment)

Type	Homogeneous earthfill
Length (feet)	
Design	484
Existing	400
Height (feet)	
Design	8
Topwidth (feet)	
Design	10
Existing	3
Side Slopes	
Design	
Upstream	1V on 2H
Downstream	1V on 2H
Existing Conditions	
Upstream	1V on 19H
Downstream	Varies, 1V on 3.4H, minimum.

	Zoning	None.
	Cut-off	None.
	Grout Curtain	None.
h.	Diversion and Regulating Tunnel.	None.
i.	Spillways.	
	Main Spillway	
	Type	Masonry gravity weir with near-OGEE concrete crest.
	Length of Weir (feet)	
	Design	58.0
	Existing	58.5
	Crest Elevation (existing)	1839.4
	Upstream Channel	Reservoir
	Downstream Channel	Natural stream. A 20-foot long concrete apron is at streambed immediately below the weir.
	Auxiliary Spillway	
	Type	Earth cut with earthen control section
	Length of Weir (feet)	29
	Crest Elevation	1841.0
	Upstream Channel	Reservoir
	Downstream Channel	Supercritical, grass-lined cut to existing stream.
j.	Regulating Outlets.	

Type	One 18-inch diameter corrugated metal pipe (CMP).
Length (feet)	8
Closure	Sluice gate on upstream side of main spillway wall.
Access	Right side of main spillway.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. Some engineering data are available for the structure as originally designed. Most of the data is contained in the Pennsylvania Department of Environmental Resources (PennDER) files. The original designer revealed that no additional information is available for the original structure.

There is good information on the flashboard structural design; these were added as a modification to the dam. The auxiliary spillway was also added as a modification; the plans for this structure are adequate. Hydraulic data are lacking for both the auxiliary spillway and flashboard design. There is no information concerning changes made to the embankment since its acquisition by the present Owner.

Although the construction data are lacking, the original designer, who was on the site periodically during construction, stated that he was not aware of any problems encountered during construction.

b. Design Features. The project is described in Paragraph 1.2a. The various features of the dam are shown on the Plates at the end of the Report and on the Photographs in Appendix D. The embankment is shown on Plates 2 and 3A and on Photographs A, B, and C. The main spillway is shown on Plates 2, 3B, and 4 and on Photographs D and E. The outlet works is shown on Plate 3B and on Photograph D. The auxiliary spillway is shown on Plate 5 and on Photographs E and F.

c. Design Considerations. The embankment was designed without any cutoff provisions. Current standard practice would require either cutoff provisions or an analysis of the foundation soils. The design of the flashboards is discussed in Section 5.

2.2 Construction.

a. Data Available. The available data are very limited. As noted previously, there were no reported problems encountered during construction. However, the original designer and representatives of the Commonwealth

rarely visited the site during construction. Both the original designer and the Owner's present engineer were uncertain that the embankment was constructed to its design elevation.

b. Construction Considerations. There are insufficient data to assess the construction.

2.3 Operation. There are no formal records of operation. The Owner did not report any problems having occurred over the operational history of the dam.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dam Safety, Obstructions, and Storm Water Management, Department of Environmental Resources, Commonwealth of Pennsylvania, by the original designer, and by the Owner, Big Bass Lake, Inc. The Owner made available the President of the Corporation, the Maintenance Supervisor, and the Corporation's Consulting Engineer for information during the visual inspection. The Consulting Engineer and the original designer researched their files for further information at the request of the inspection team.

b. Adequacy. The type and amount of design data and other engineering data are somewhat limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data. As is noted in Section 5, the spillway crest was constructed 1 foot higher than the design drawings indicate.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is good. Some deficiencies were observed as noted below. A sketch of the dam with the location of deficiencies is presented in Appendix B on Plate B-1. Survey information acquired for this report is summarized in Appendix B. On the day of the inspection, the pool was at the top of the flashboards on the main spillway crest.

b. Embankment. The embankment is in good condition. The sand beach on the upstream slope is in excellent condition without any evidence of erosion. The grass cover on the remainder of the embankment is in good condition. There are a few holes in the downstream slope. Some holes are caused by decaying tree stumps; others are caused by burrowing animals. None of the burrowing animal holes appeared active. No seepage was observed downstream of the dam. As shown on Plate B-1, a swale was observed extending downstream from the right abutment. The Owner's engineer reported that there used to be a minor amount of seepage in the swale, but that it dried up when the Owner modified the embankment. A few stagnant pools of water were observed in the swale, which does not presently have positive drainage. The drainage in the swale was modified when the area downstream of the embankment was filled to create a parking lot.

The survey performed for this inspection revealed that the embankment slopes are much flatter than the design slopes. The slopes are indicated in Paragraph 1.3. The survey also revealed that the top of the embankment is a maximum of 0.6 foot below its design elevation. The lowest area is at the right abutment. There are mature trees growing in this area. It is uncertain whether this area is part of the embankment or the natural overburden.

c. Appurtenant Structures. The main spillway is in good condition. No seepage through the masonry was observed; however, a minor amount of flow was occurring over the flashboards, which would have obscured any minor seepage areas. Most of the flashboard pins were No. 7 reinforcing bars. For 20 feet to the right of the left end of the main spillway crest, the flashboards are supported by various pipes and pins measuring from 1 inch to 1-1/4-inches in diameter. The maintenance supervisor reported that these odd size pins had just been put in. He also reported that

the masonry in the left spillway wall had just been repointed. Small trees are growing immediately adjacent to this area. The survey performed for this inspection revealed that the main spillway crest is 0.5 foot longer than its design length. It also revealed that there is an area at the right abutment of the main spillway which is 0.3 foot below the top of the wall. For low flows; minor constrictions in the channel immediately downstream from the main spillway create a tailwater condition at the toe of the main spillway. At high flows, the constrictions would be drowned and tailwater would be controlled by a 42-inch diameter culvert under a road that is about 150 feet downstream from the main spillway. The top of the road is 2.8 feet below the main spillway crest.

The auxiliary spillway is in good condition. When the left wall of the main spillway was repointed, the grade of the auxiliary spillway was disturbed. One end of the control section is 0.2 foot above its design elevation. The grass cover in the auxiliary spillway channel is in generally good condition.

The outlet works is in good condition. The sluice gate was opened about 10 percent by one man in about 5 minutes with no apparent problems. The sluice gate is attached to upstream side of the right spillway wall, which is directly exposed to the reservoir.

d. Reservoir Area. Most of the watershed is owned by Big Bass Lake, Inc. The USGS mapping indicates extensive swamps in a significant portion of the watershed. The remainder of the watershed is rolling hills; it is mostly wooded, but developed to a minor extent on the left side by the Big Bass Lake Development.

e. Downstream Conditions. Tamarack Creek flows from the main spillway through a narrow valley for 0.5 mile to Pennsylvania Route 307 (PA-307), where it flows through a small culvert under the road. Immediately upstream of the road there are two dwellings and at least 8 trailers immediately adjacent to the stream. These structures are less than 10 feet above streambed. The stream then continues for 0.9 mile to its confluence with the Lehigh River just upstream of Interstate -380 (I-380).

The embankment is in a saddle. A small stream, termed Lehigh Run in some reports, used to flow through the saddle. The streambed extends for 0.6 mile from the embankment to the Lehigh River through a relatively wide valley. The Lehigh River, which is fairly narrow in this

reach, extends for 0.8 mile under both PA-309 and a local road, to its confluence with Tamarack Creek just upstream of I-380. Some camp buildings are located 0.2 mile upstream from the confluence at the right bank of the Lehigh River. Access to both the dam and the embankment is via many public and private roads that are downstream from the structures.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at the top of the flashboards on the spillway crest, with excess inflow discharging over the spillway and into Tamarack Creek. An 18-inch diameter corrugated metal pipe discharges into Tamarack Creek. Since the pipe is used only to lower the lake, it is usually closed. The lake is lowered annually to maintain the beach on the embankment.

4.2 Maintenance of Dam. The dam is visited daily by the maintenance supervisor, who observes the general condition of the dam. The brush and grass are cut very frequently. The flashboards are inspected by the Owner's engineer annually and reports are sent to Clifton Township. Other than this, formal annual inspections are not performed.

4.3 Maintenance of Operating Facilities. The outlet works gate is operated annually to lower the lake.

4.4 Warning Systems in Effect. The Owner stated that there is no emergency operation and warning system. He was not familiar with the downstream conditions.

4.5 Evaluation of Operational Adequacy. The maintenance of the dam is good. However, the Owner is apparently not familiar with certain requirements of dam maintenance, especially with the flashboard pins. The daily inspection program is good, but formal annual inspections by a professional engineer are necessary to detect potentially hazardous conditions. An emergency operation and warning system is necessary to mitigate any hazards downstream, should there be evidence of stress at the dam.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. The data available for review consist of the original main spillway design. The capacity was estimated at 1,140 cfs, using 3 feet of head over the main spillway crest. However, judging by the existing conditions at the site and the end-of-construction photographs in the PennDER files, the main spillway crest was constructed 1.0 foot above its design elevation. Although Plates 3A and 3B show 3 feet between the main spillway crest and the top of the walls, the difference measured in the field was only 2 feet. The spillway has since been modified by the addition of flashboards. Also, an auxiliary spillway has been constructed. No estimate of the spillway capacity with these features is available. The estimated spillway capacity for the various conditions is presented in Appendix C.

The design of the flashboards is presented on Plate 4. The design utilized No. 7 reinforcing bars. The designer assumed that the bars would fail at a yield stress of 36,000 psi. Reinforcing bars are not usually supplied with a yield stress of 36,000 psi. Normally, they are supplied at 40,000; 50,000; and 60,000 psi. Furthermore, yield stress is not the usual criteria used in the design of flashboards because, even if yield stress were exceeded, it would only guarantee a slight plastic deformation but not failure. The usual flashboard design uses hollow pipes. Ultimate stress is usually used to ensure failure. For these reasons, the analysis described hereafter for the existing conditions assumes that the flashboards remain intact.

b. Experience Data. The Owner stated that no records of maximum pool levels were available. The original designer reported that the largest flow he recollected was during Tropical Storm Diane in 1955, when the pool was near the top of the spillway walls. This is used as the flood of record.

c. Visual Observations.

(1) General. The visual inspection of Big Bass Lake Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The low areas on the top of the embankment reduce the spillway capacity, assuming that the main spillway walls could be overtopped. The unprotected upstream slope is an erosion hazard. However, the slope is almost flat, which reduces the hazard greatly. Daily inspections and good maintenance, as are now being performed, negate any hazard that might exist.

(3) Appurtenant Structures. The main spillway crest was constructed 1 foot above its design elevation, as noted in Paragraph 5.1a. This paragraph also notes that the flashboards are assumed not to fail. Both these conditions significantly reduce the spillway capacity.

The auxiliary spillway is similar to a Soil Conservation Service (SCS) auxiliary spillway design. The SCS usually designs auxiliary spillways to pass floods greater than a 100-year frequency. As the auxiliary spillway crest at Big Bass Lake Dam is only 0.5 foot above the top of the flashboards, it will probably have water flow in it at significantly less than a 100-year frequency.

(4) Reservoir Area. The development covers a sufficiently small part of the watershed and is sufficiently sparse that it will have a negligible effect on the hydrology. Although the swamps in the watershed may have a significant effect on runoff from small storms, they will probably have negligible effect on a Probable Maximum Flood (PMF), which assumes saturated soil conditions. The assessment of the dam is based on existing conditions, and the effects of future development are not considered.

(5) Downstream Conditions. Access to all features of the dam is good. No conditions were observed downstream from the dam that might present significant hydraulic hazard to the dam. It is estimated that the roadway embankment downstream will not produce a backwater effect on the spillway crests. It is probably beneficial hydraulically in that the tailwater creates a plunge pool. As described in Paragraph 3.1e, the failure of the main spillway weir or the embankment could cause loss of life, although at different areas. Because of the potential for loss of life if the dam were to fail, a high hazard classification is warranted for Big Bass Lake Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (Small)

and hazard potential (High) of Big Bass Lake Dam is between the Probable Maximum Flood (PMF) and the 1/2 PMF. Because there are at least 10 dwellings downstream, the PMF is selected as the SDF.

(2) Description of Model. The watershed was modeled with the HEC-1DB computer program. The HEC-1DB computer program computes a PMF runoff hydrograph and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. The PMF inflow to Big Bass Lake was routed through the dam. Identical methods were used for various percentages of the PMF.

(3) Summary of Results. Pertinent results are tabulated at the end of Appendix C. The analysis reveals that the dam can pass about 10 percent of the PMF without overtopping of the low area by the main spillway walls and about 20 percent of the PMF without overtopping of the existing top of the embankment. If the flashboards were removed, the dam could pass about 23 percent of the PMF without overtopping of the low area by the main spillway walls.

(4) Spillway Adequacy. The criteria for rating a spillway is presented in Appendix C. As described in Section 6, the stability of the existing main spillway weir is considered marginal for the normal operating condition. As the lake rises, the stability of the main spillway weir worsens. It was assumed that the weir would overturn during the 20 percent PMF storm when the spillway walls would be overtopped by 0.3 foot. Failure was assumed to be complete within 0.1 hour. The breach would create a peak outflow of 6,960 cfs. This was routed to the damage center, where it raises the water surface by 2.8 feet. There is an increased hazard to loss of life. The spillway capacity is rated as seriously inadequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Big Bass Lake Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. The pools of water in the swale were sufficiently far from the embankment that it seems unlikely that they were caused by water from the reservoir. The assessment of the Owner's engineer concerning the elimination of the seepage appears correct. The stump and burrowing animal holes provide a potential seepage path. The trees at the right abutment are undesirable, however, they do not appear to be a significant hazard. As it is uncertain that the embankment was constructed to its design elevation, the low areas could have been caused by settlement or poor construction practice.

(3) Appurtenant Structures. The small trees growing at the left of the main spillway are a hazard because their roots tend to dislodge the masonry blocks. As this area has just been repointed, the hazard is very minor at present.

b. Design and Construction Data. No stability analysis was performed for the embankment. A stability analysis was performed for the main spillway weir during the design of the dam. The computations are in the PennDER files. The results are shown on Plates 3A and 3B. On this plate Case 1 indicates reservoir empty, Case 2 indicates reservoir full-no uplift, and Case 3 indicates reservoir full-uplift. The uplift was computed using 50 percent of the head and no tailwater. The analysis was for the weir as designed, the crest was constructed 1 foot above the design elevation. The toe pressure was not addressed in the analysis.

In conjunction with this report, analyses were performed using the following assumptions: Full hydrostatic head on the upstream face and downstream face; and uplift of full tailwater head at the heel and toe plus 2/3 the difference between headwater and tailwater at the heel. Only the section at the bottom of the footing was analyzed. The results are summarized in the following table.

Condition	Resultant Distance Inside Toe (Ft.)	Toe Pressure Tons/Square Foot
1. Pool at 1/2 PMF level tailwater 3 ft. below flashboard crest.	0.42	5.9
2. Pool at flashboard crest tailwater 2 ft. above streambed.	0.95	3.0
3. Pool at main spillway crest tailwater 2 ft. above streambed.	1.6	1.8

The foundation of the structure is described in the PennDER files as a "light grey clay intermixed with rocks and boulders." It should be noted that the section analyzed is assumed, because the design and as-built crest elevation vary by 1 foot. The soil properties of the foundation are unknown. According to the OCE Guideline for Stability, the resultant should be within the middle third and that the toe pressure should be within acceptable limits. The resultant is outside the middle third in all the cases noted above. For the pool at flashboard crest, the toe pressure is marginal. For the pool above flashboard crest, the toe pressure is excessive.

c. Operating Records. There are no formal records of operation. No evidence of instability on any feature of the dam has been noted.

d. Post-Construction Changes. As described previously, the addition of flashboards on the main spillway weir has not improved the stability of the structure. The regrading of the embankment flattened the slopes and probably significantly improved its stability, although definite construction data are lacking.

e. Seismic Stability. Big Bass Lake Dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone has adequate factors of safety under static loading conditions, it can be assumed safe for any expected earthquake loading. However, since there are no formal static stability analyses, and there is the potential of earthquake forces moving or cracking the masonry main spillway, the theoretical seismic stability of Big Bass Lake Dam cannot be assessed.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on available records, visual inspection, calculations, and past operational performance, Big Bass Lake Dam is judged to be in good condition. However, the spillway will pass only 10 percent of the PMF without overtopping of the low area by the main spillway walls and 20 percent of the PMF without overtopping of the existing embankment. The Owner has placed flashboards along the spillway crest. Because of their design, the flashboards cannot be relied upon to properly function. It is assumed that the main spillway would overturn during the 20 percent PMF storm. This would result in a loss of life downstream. The spillway capacity is rated as seriously inadequate. According to criteria established for these studies, the dam must be rated as unsafe, nonemergency, because the spillway capacity is seriously inadequate.

(2) The stability of the main spillway is marginal for the normal operating condition and significantly worse for higher pool conditions. There is no evidence of problems threatening the stability of the embankment.

(3) If the flashboards were removed, the dam could pass about 23 percent of the PMF without overtopping of the low area by the main spillway walls. The removal of the flashboards would significantly improve the stability of the main spillway.

(4) A summary of the features and observed deficiencies is listed below:

Feature and Location	Observed Deficiencies
Embankment:	
Upstream Slope	Unprotected by riprap but very flat.
Downstream Slope	Burrowing animal and stump holes.
Toe	Dry seepage path.

Outlet Works:

Gate and Operator	Susceptible to ice damage.

Main Spillway:

Left Abutment	Small trees adjacent.

b. Adequacy of Information. The information available is such that an assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations of Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Remove the flashboards from the main spillway crest.

(2) Engage the services of a professional engineer experienced in the design and construction of dams to perform the following studies: a study to more accurately determine the spillway capacity required at the dam and the measures required to make the spillway hydraulically adequate, and a study to determine the structural integrity of the main spillway and the measures required to make the spillway structurally adequate. As a minimum, the studies will require an exploration program to determine the engineering properties of the main spillway foundation soils. Take appropriate action as necessary.

(3) Provide protection against ice damage at the outlet works gate.

(4) Raise the embankment to its design elevation.

(5) As part of the regular maintenance program, remove trees close to the main spillway weir, fill the burrowing animal and stump holes, and monitor the dry seepage path by the right abutment of the embankment. If seepage is noted, have it evaluated by a professional engineer, as noted above. Also, as part of this program, continue observing the upstream slope of the embankment, especially after floods. If erosion is noted, continue the present practice of effecting repairs immediately.

b. In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Big Bass Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Big Bass Lake Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) As presently required by the Commonwealth, institute a program of formal annual inspections by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

DELAWARE RIVER BASIN

TAMARACK CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

BIG BASS LAKE DAM

NDI ID No. PA-00368
DER ID No. 35-126

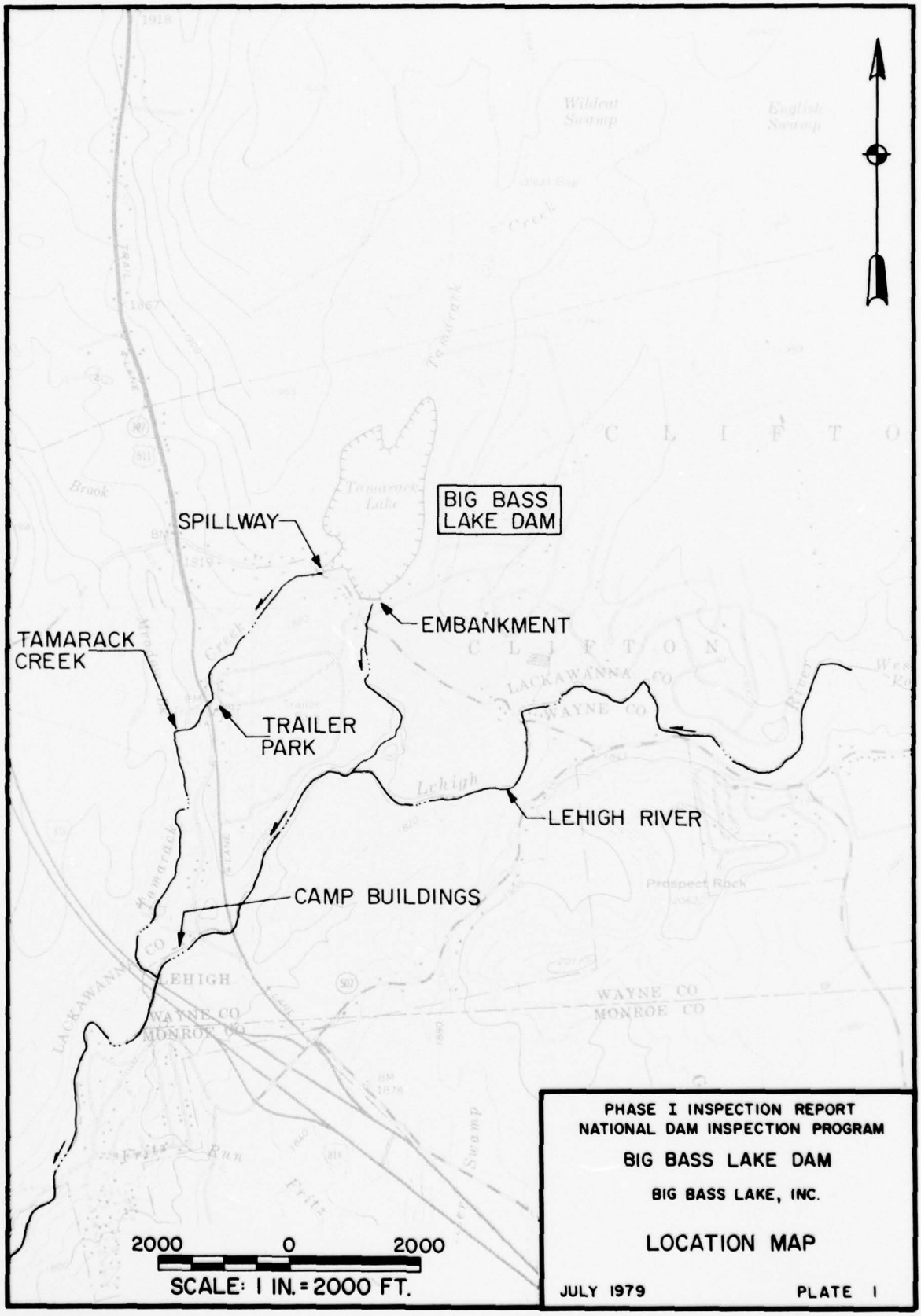
BIG BASS LAKE, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JULY 1979

PLATES



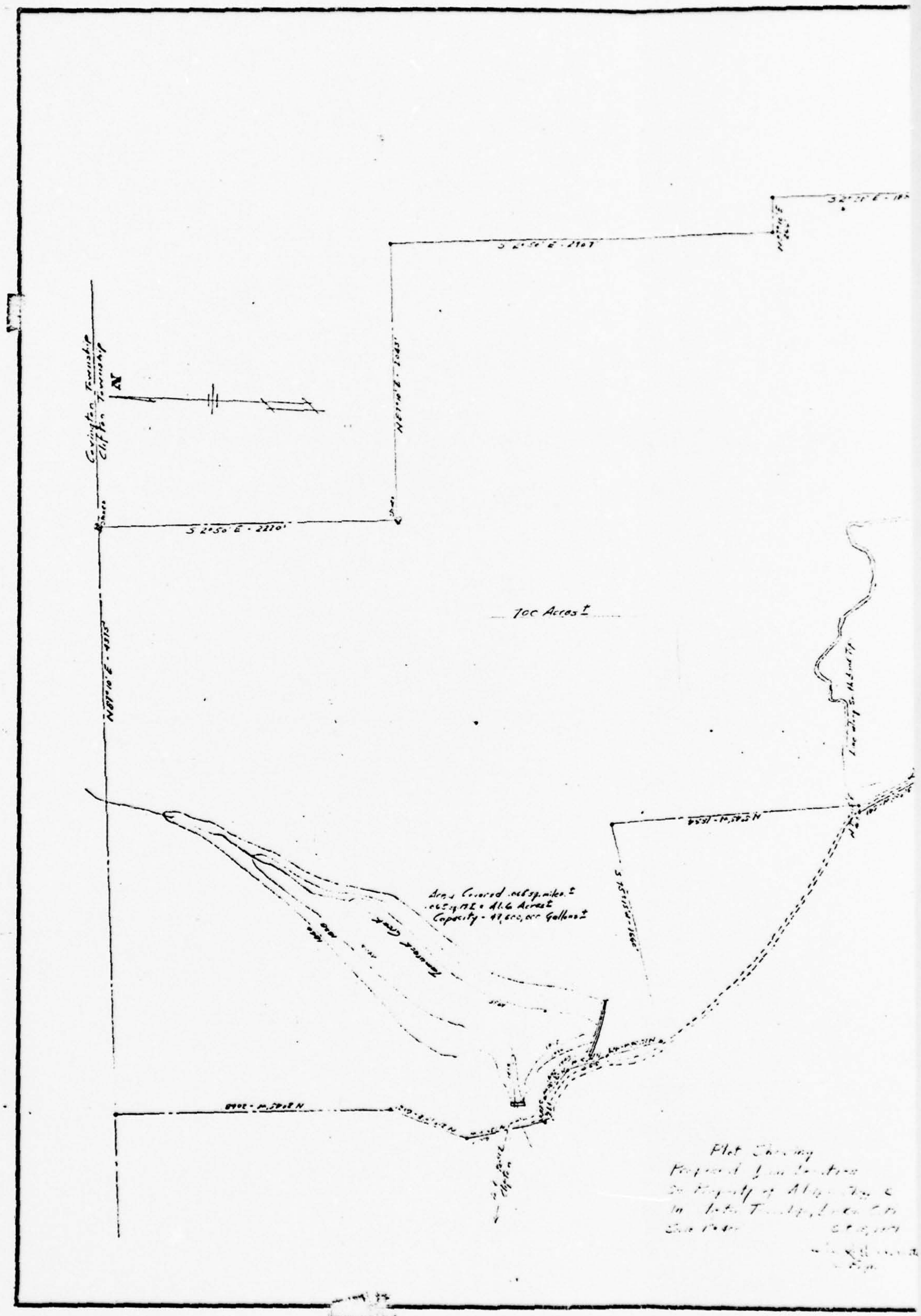
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

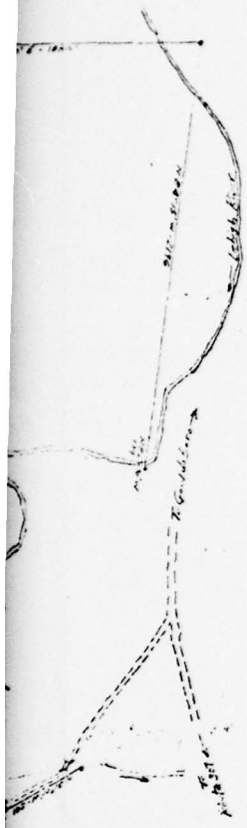
BIG BASS LAKE DAM

BIG BASS LAKE, INC.

LOCATION MAP

JULY 1979 PLATE 1


Covington Township
Clifton Township
N
S 2°50' E - 2220'
Acres ±
Area Covered
Capacity
Gallons ±
Plat Showing



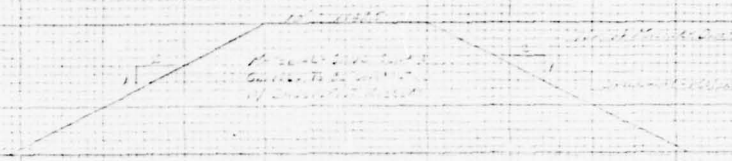
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

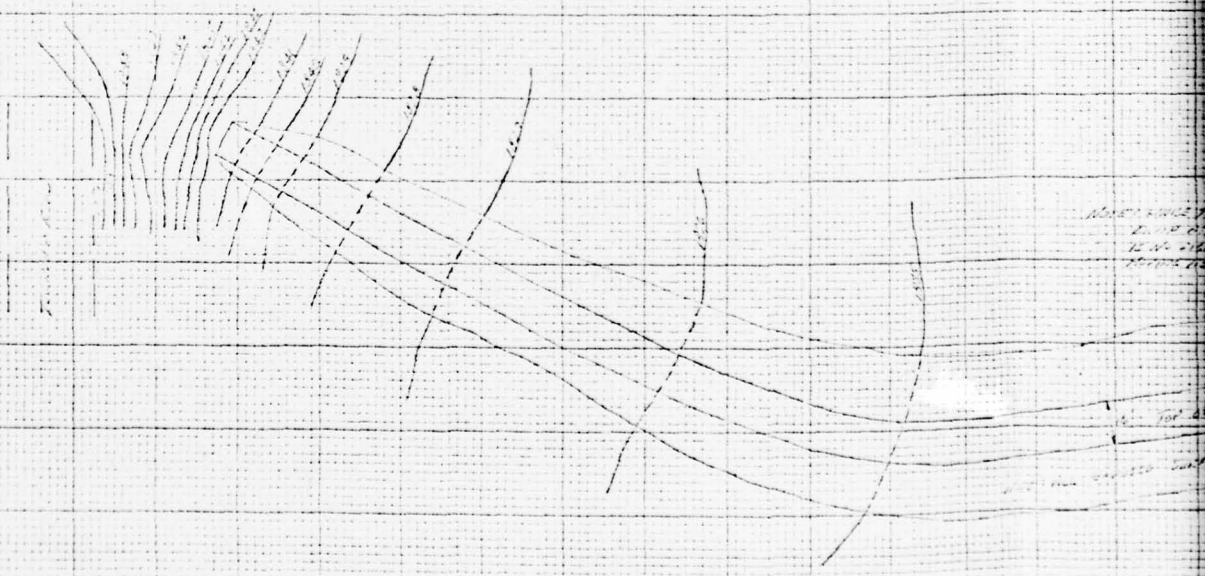
BIG BASS LAKE DAM

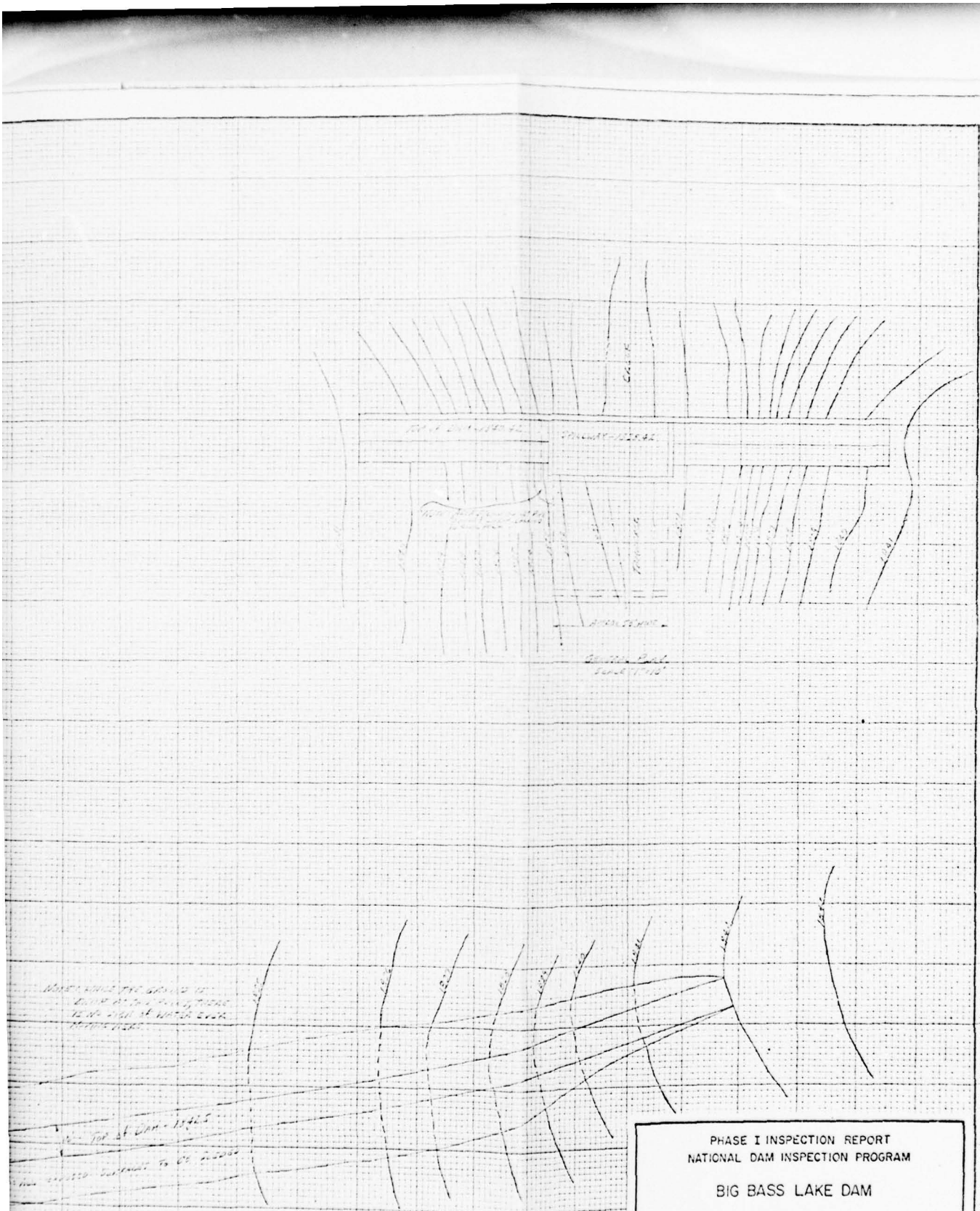
BIG BASS LAKE, INC.

SITE PLAN

JULY 1979 PLATE 2







NOTE: This Plate and Plate 3B traced from poor quality prints in Penn DER files.

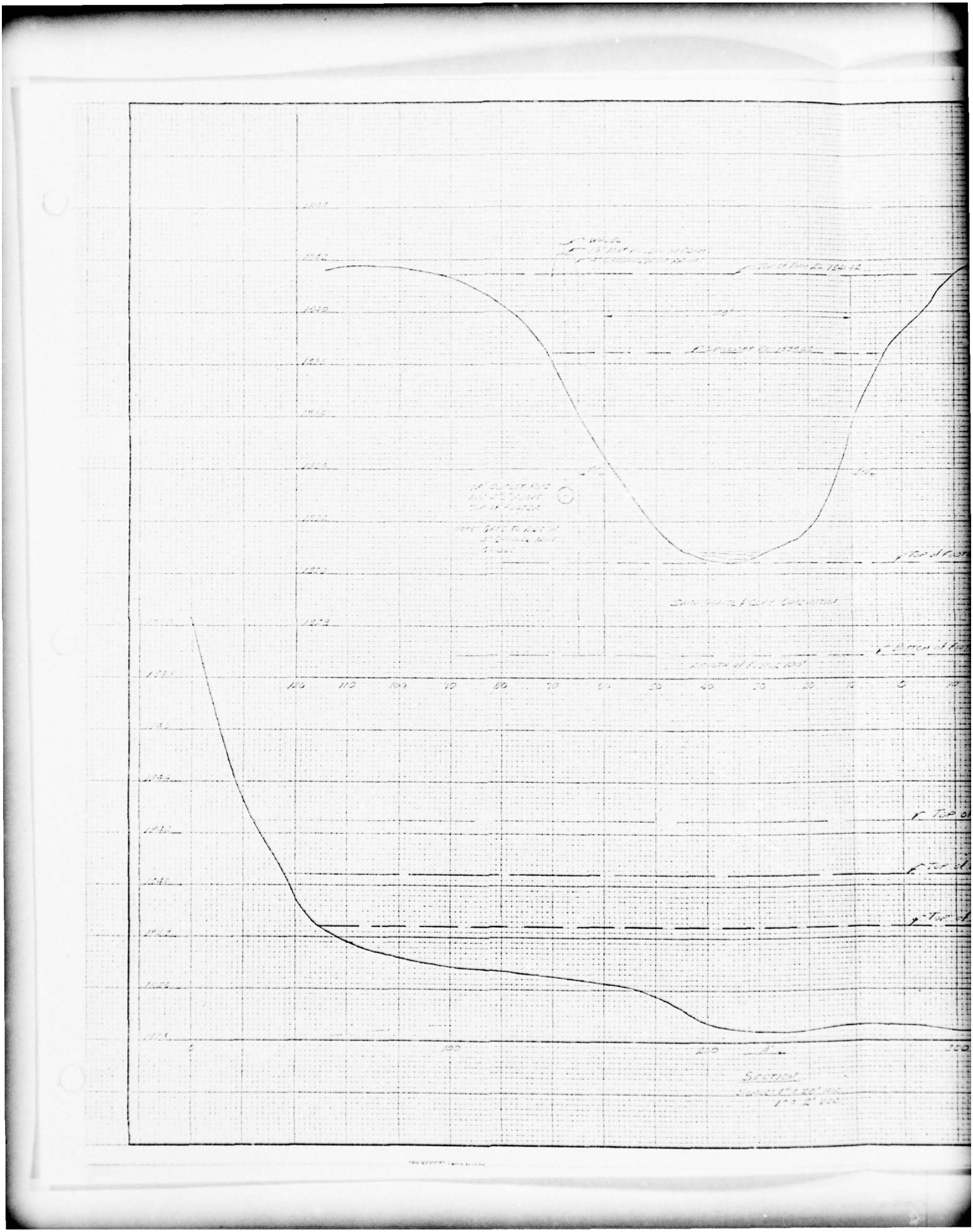
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

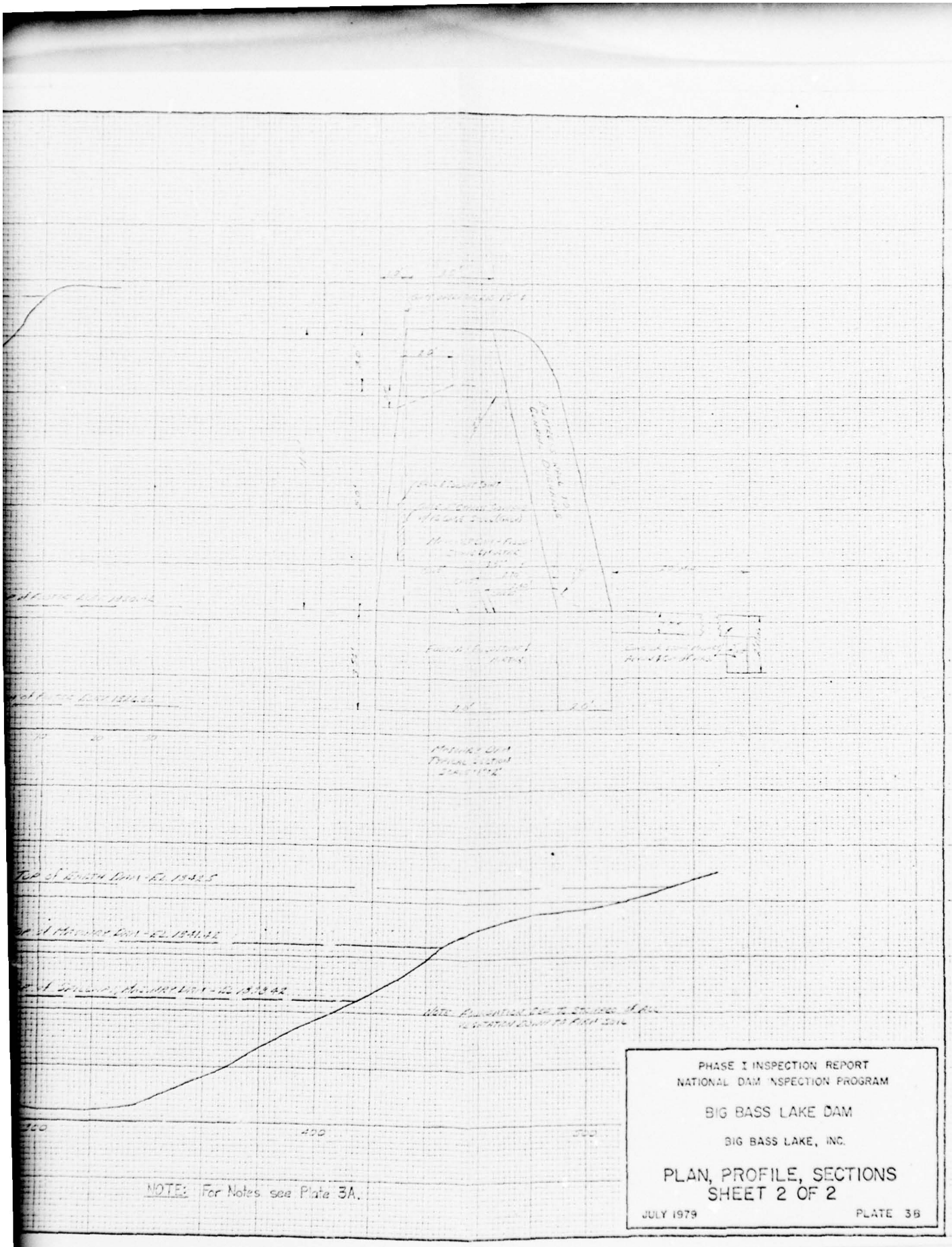
BIG BASS LAKE DAM

BIG BASS LAKE, INC.

PLAN, PROFILE, SECTIONS
SHEET 1 OF 2

JULY 1979 PLATE 3A





NOTE: For Notes see Plate 3A.

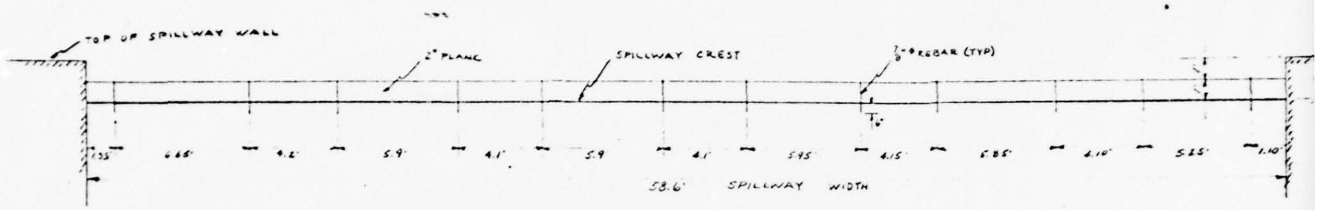
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BIG BASS LAKE DAM

BIG BASS LAKE, INC.

PLAN, PROFILE, SECTIONS
SHEET 2 OF 2

JULY 1979 PLATE 3B



SPILLWAY ELEVATION
SCALE 1"=5'

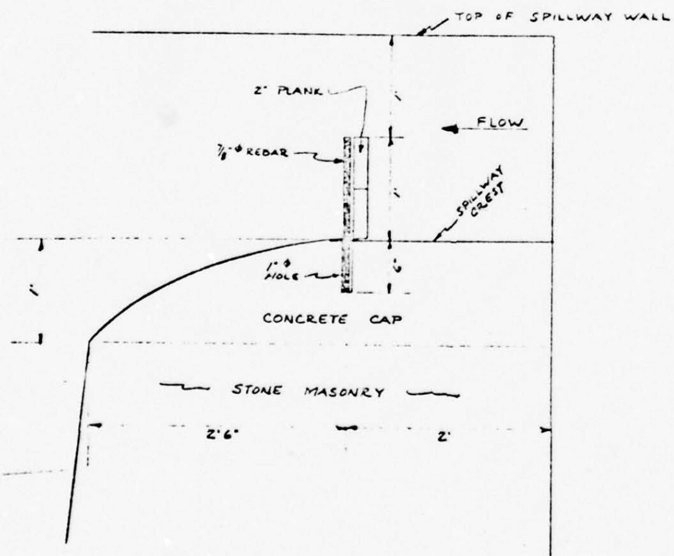
COMPUTATIONS:

AVERAGE SPACING OF BARS = 5'

MOM AT "A" PER BAR =
5 (62.4 × .5 + 62.4 × .33/2) = 2[...]

SECTION MOD OF BAR = $\frac{\pi d^3}{32} = \frac{\pi (7/8)^3}{32}$ = [...]

$f = \frac{M}{S} = \frac{208 \times 12}{.066}$ = 37818 PSI
> 3600[...] YIELD



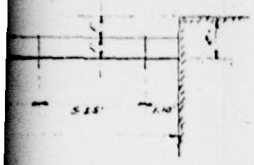
SPILLWAY SECTION
SCALE 1"=1'

PROPOSED ADDITION TO SPILLWAY

BIG BASS LAKE

CLIFTON TWP. - LACKAWANNA CO. - PENN[...]
DEC. 15, 1972 SCALE AS SHOWN

EDWARD C. HESS ASSO. INC.
STROUDSBURG, PA



BARS : 5'

PER BAR :

.5 + 62.4 + .33/2) = 206 FT-LB

OF BAR : $\frac{\pi d^3}{32} = \frac{\pi(1)^3}{32} = .066\ IN^3$

$\frac{206 \cdot 12}{.066}$, 37818 PSI

> 36000 PSI
YIELD OF STEEL

TO SPILLWAY

SS LAKE

AWANNA CO. - PENNA.
SCALE AS SHOWN

SS ASSO. INC.
RG, PA

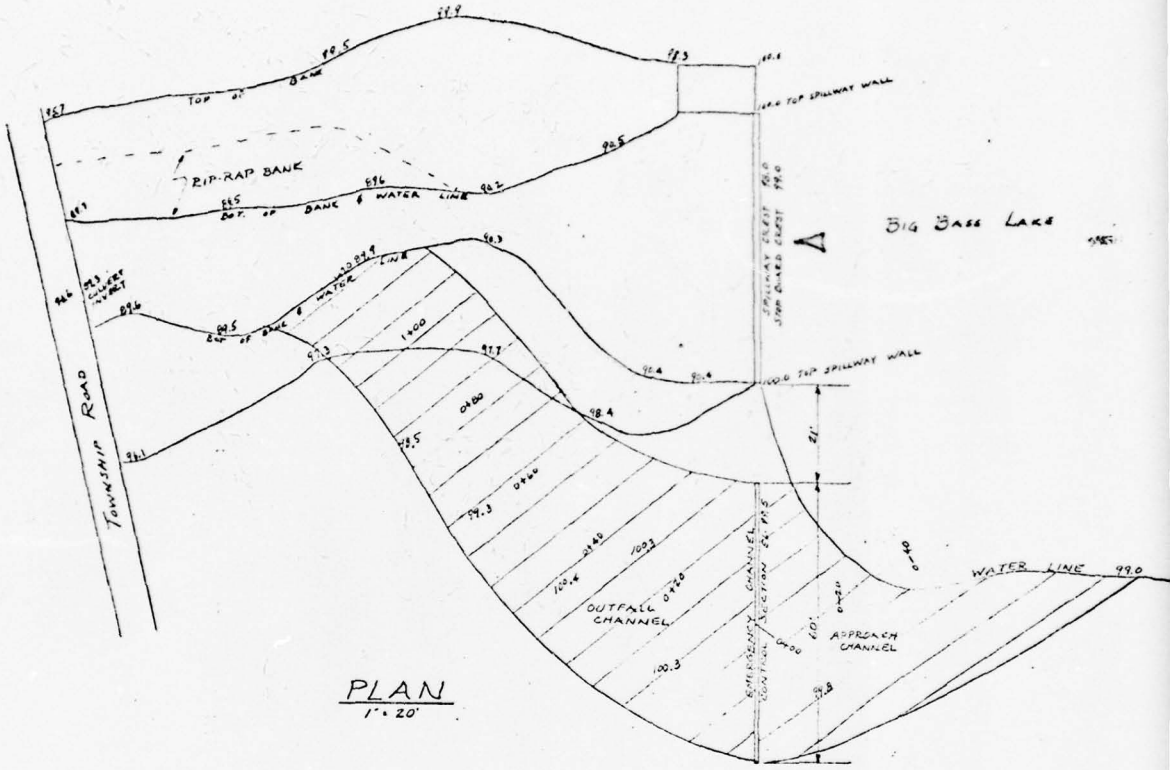
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BIG BASS LAKE DAM

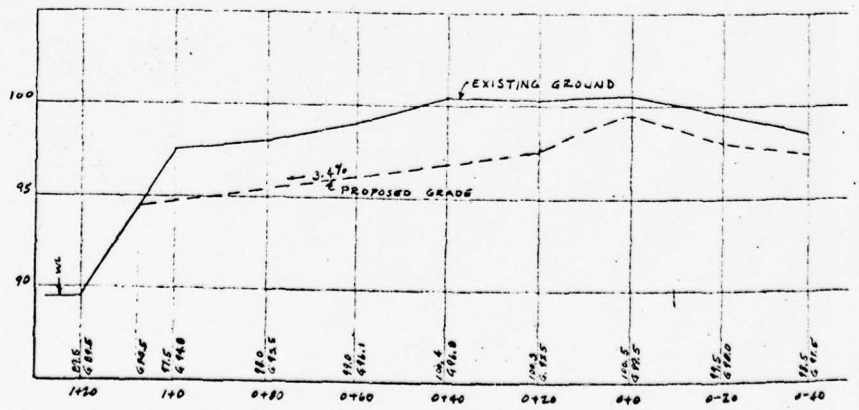
BIG BASS LAKE, INC.

FLASHBOARD DETAILS

JULY 1979 PLATE 4



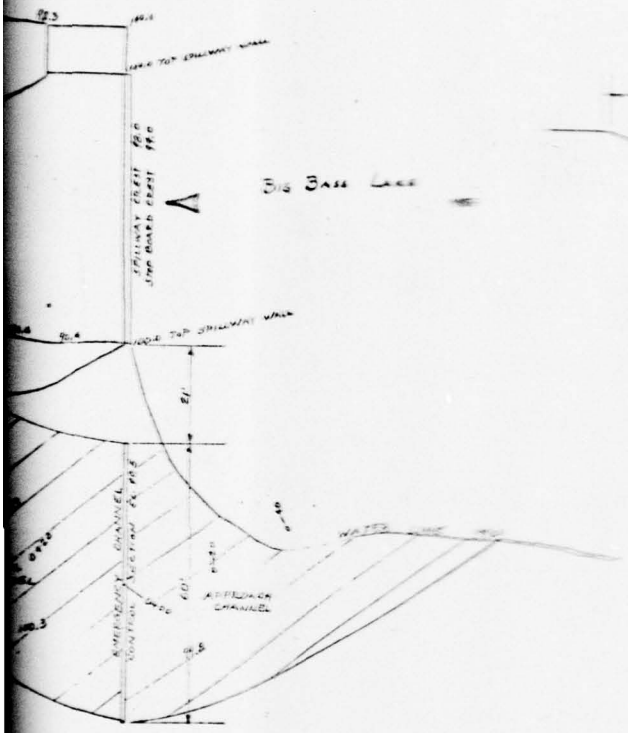
PLAN
1" = 20'

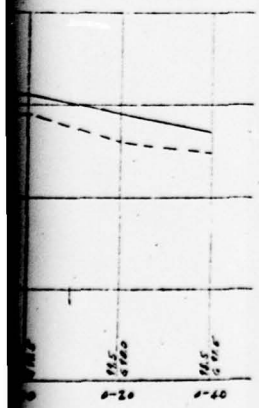


PROFILE - EMERGENCY CHANNEL
HORZ 1" = 20' VERT 1" = 5'

PROPOSED EMERG
BIG BA
CLIFTON TWP. - LAC
APR. 14, 1973

EDWARD C. H
STROUDSB





PROPOSED EMERGENCY SPILLWAY

BIG BASS LAKE

CLIFTON TWP. - LACKAWANNA CO. PENNA.
APRIL 19, 1979 SCALE AS SHOWN

SOURCE OF DATA: FIELD SURVEY BY
STRAUB ASSOCIATES, P.C.

PROJECT ENGINEER'S CERTIFICATE
NATIONAL DAM INSPECTION PROGRAM
BIG BASS LAKE DAM
BIG BASS LAKE, INC.
AUXILIARY SPILLWAY
JULY 1979 PLATE No.

DELAWARE RIVER BASIN

TAMARACK CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

BIG BASS LAKE DAM

NDI ID No. PA-00368
DER ID No. 35-126

BIG BASS LAKE, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JULY 1979

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: BIG BASS LAKE
NDS ID NO.: I PA-00368 DER ID NO.: 35-126

ITEM	REMARKS
AS-BUILT DRAWINGS	NONE - FOR DESIGN DRAWING SEE PLATES 3A & 3B
REGIONAL VICINITY MAP	SEE PLATES 1 & 2
CONSTRUCTION HISTORY	BUILT 1952-1957
TYPICAL SECTIONS OF DAM	SEE PLATES 3A & 3B
OUTLETS: Plan Details Constraints Discharge Ratings	SEE PLATES 3A & 3B

A-1

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NONE
DESIGN REPORTS	DESIGN ANALYSIS by PENNDER
GEOLOGY REPORTS	NONE
DESIGN COMPUTATIONS: Hydrology and Hydraulics (H&H) Dam Stability Seepage Studies	H&H - PASS CURVE "C" BUT AS-BUILT CREST ELEVATION 1 FOOT HIGHER STABILITY - IN PENNDER FILES SEEPAGE - NONE
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	NONE
POSTCONSTRUCTION SURVEYS OF DAM	NONE

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	ASSUMED ON SITE.
MONITORING SYSTEMS	NONE
MODIFICATIONS	EMBANKMENT REGRADED - 1971 FLASHBOARDS ADDED - 1972 AUXILIARY SPILLWAY ADDED - 1973
HIGH POOL RECORDS	VERBAL REPORT FROM ORIGINAL DESIGNER - TROPICAL STORM DIANE, 1955 WATER AT TOP OF MAIN SPILLWAY WALL.
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	NONE

D-13

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	NONE
SPILLWAY: Plan Sections Details	SEE PLATES 3A & 3B
OPERATING EQUIPMENT: Plans Details	SEE PLATES 3A & 3B
PREVIOUS INSPECTIONS Dates Deficiencies	1957 - NO DEFICIENCIES 1960 - (INFORMAL by PENNDER) - NO DEFICIENCIES 1963 (INFORMAL by PENNDER) - NO DEFICIENCIES EXCEPT SOME LEAKAGE AT DIKE" 1973 - (INFORMAL by PENNDER) - NO DEFICIENCIES.
	1975 - (INFORMAL by PENNDER) - NO DEFICIENCIES.

DELAWARE RIVER BASIN

TAMARACK CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

BIG BASS LAKE DAM

NDI ID No. PA-00368
DER ID No. 35-126

BIG BASS LAKE, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JULY 1979

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: BIG BASS LAKE County: LACKAWANNA State: PENNSYLVANIA

NDI ID No.: PA-00368 DER ID No.: 35-126

Type of Dam: HOMOGENEOUS EARTHFILL EMBANKMENT MASONRY GRAVITY SPILLWAY Hazard Category: HIGH

Date(s) Inspection: 15 JUNE 1979 Weather: CLEAR Temperature: 70°F

SOIL CONDITIONS: DRY AT SURFACE

W-1

Pool Elevation at Time of Inspection: 1840.5 msl/Tailwater at Time of Inspection: 1832.0 msl

Inspection Personnel:

L. LARSEN (BIG BASS) D. WILSON (GFCC)

D. REBAR (BIG BASS) D. EBERSOLE (GFCC)

C. DENNIS (HESS ENGINEERS)

A. WHITMAN (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	NONE	
CREST ALIGNMENT: Vertical Horizontal	HORIZONTAL - NO DEFICIENCIES VERTICAL - SEE SURVEY DATA AFTER INSPECTION FORMS.	
RIPRAP FAILURES	NO RIPRAP SAND BEACH ON UPSTREAM SLOPE IN EXCELLENT CONDITION.	

B-2

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	MATURE TREES AT RIGHT ABUTMENT. SWALE WITH STAGNANT POOLS AT RIGHT ABUTMENT.	
ANY NOTICEABLE SEEPAGE	NONE, STAGNANT POOLS NOTED ABOVE ARE QUITE FAR FROM THE EMBANKMENT.	
STAFF GAGE AND RECORDER	NONE	
DRAINS	NONE	
OTHER	HOLES IN EMBANKMENT FROM BURROWING ANIMALS AND DECAYING STUMPS.	ANIMAL HOLES NOT ACTIVE.

W
I
N

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A CORRUGATED METAL PIPE	
INTAKE STRUCTURE	SUBMERGED	
OUTLET STRUCTURE	FREE OUTFALL	
OUTLET CHANNEL	NATURAL STREAM	
EMERGENCY GATE	OPENED 10% BY 1 MAN IN 5 MINUTES WITH NO PROBLEMS. GATE LEAKS SLIGHTLY	GATE AND OPERATOR EXPOSED TO ICE IN RESERVOIR.

W-I-T

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR ↑ AND MASONRY	NONE	SLIGHT FLOW OVER FACE COULD HAVE OBSCURED MINOR SEEPAGE. TREES AT LEFT ABUTMENT.
APPROACH CHANNEL	RESERVOIR	
DISCHARGE CHANNEL	NATURAL STREAM	
BRIDGE AND PIERS	NONE	
FLASHBOARDS	PINS #7 REINFORCING BARS EXCEPT FOR 20' NEAR LEFT END ODD SIZE PINS 1" TO 1¼" DIAMETER.	MAINTENANCE SUPERVISOR SAYS odd SIZE PINS WERE JUST INSTALLED.

W-51

AUXILIARY ~~GATED~~ SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
~~CONCRETE SILL~~ CONTROL SECTION	UNEVENLY GRADED - SEE SURVEY DATA FOLLOWING INSPECTION FORM	
APPROACH CHANNEL	RESERVOIR	
DISCHARGE CHANNEL	GRASSED, SUPERCRITICAL TO NATURAL STREAM.	GRASS GENERALLY GOOD CONDITION.
BRIDGE AND PIERS	NONE	
GATES AND OPERATION EQUIPMENT	NONE	

E-6

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE	
OBSERVATION WELLS	NONE	
WEIRS	NONE	
PIEZOMETERS	NONE	
OTHER	NONE	

W-7

RESERVOIR AND WATERSHED

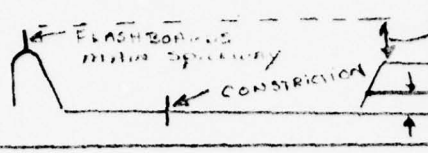
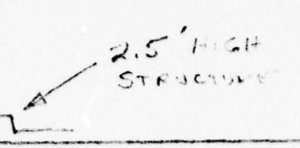
Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Rolling Hills	
SEDIMENTATION	No Reported or Observed problems	
WATERSHED DESCRIPTION	Swamps in significant portion - See Plate 1. Minor development by Big Bass Lake, Inc.	

N-18

DOWNSTREAM CHANNEL

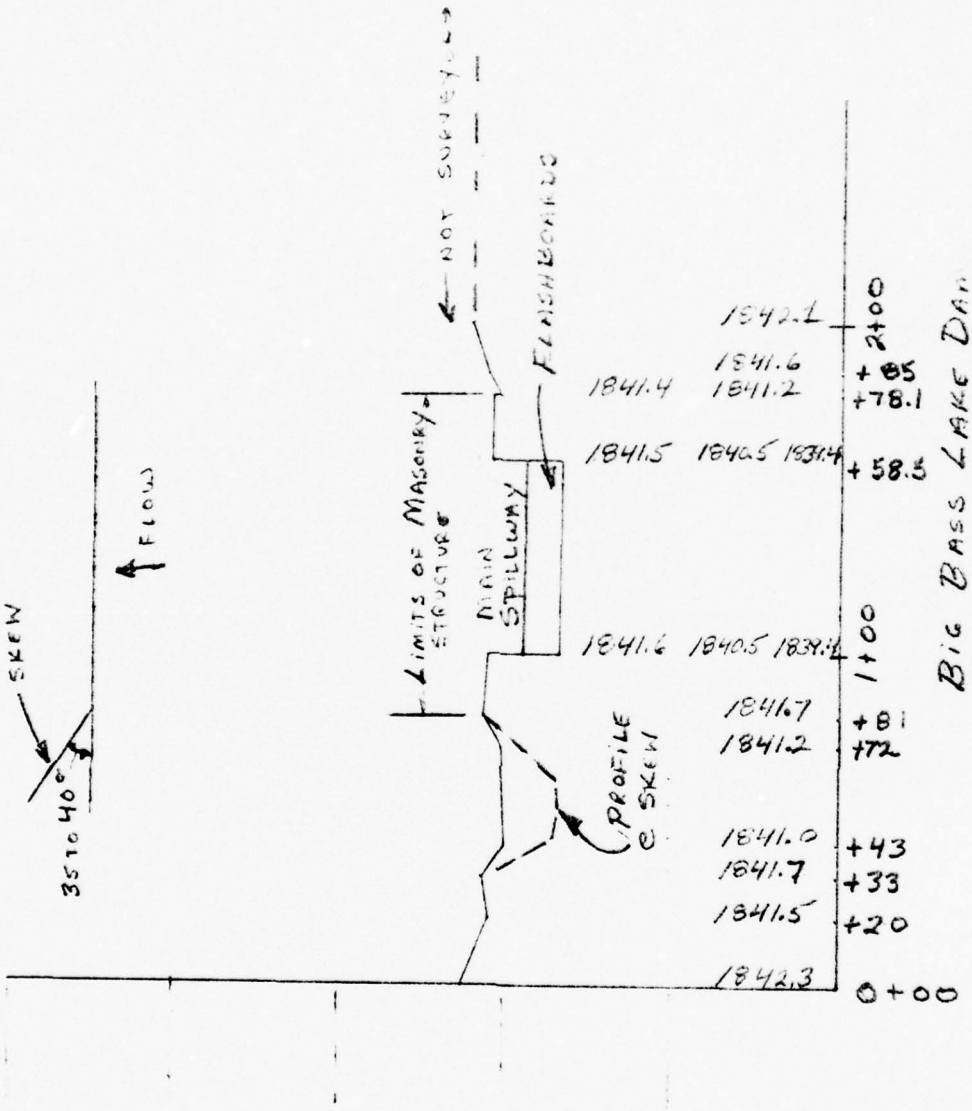
Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other		
SLOPES	TAMARACK CREEK IS STEEP.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	ON TAMARACK CREEK 2 HOUSES & 8 TRAILERS, ALL LOW & NEAR STREAM JUST UPSTREAM PA-307	

E 1 5

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. _____ OF _____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



BIG BASS LAKE DAM
PROFILE - SPILLWAY AREA
SCALES: HOR. 1"=5'
VERT. 1"=5'

13-10

8513

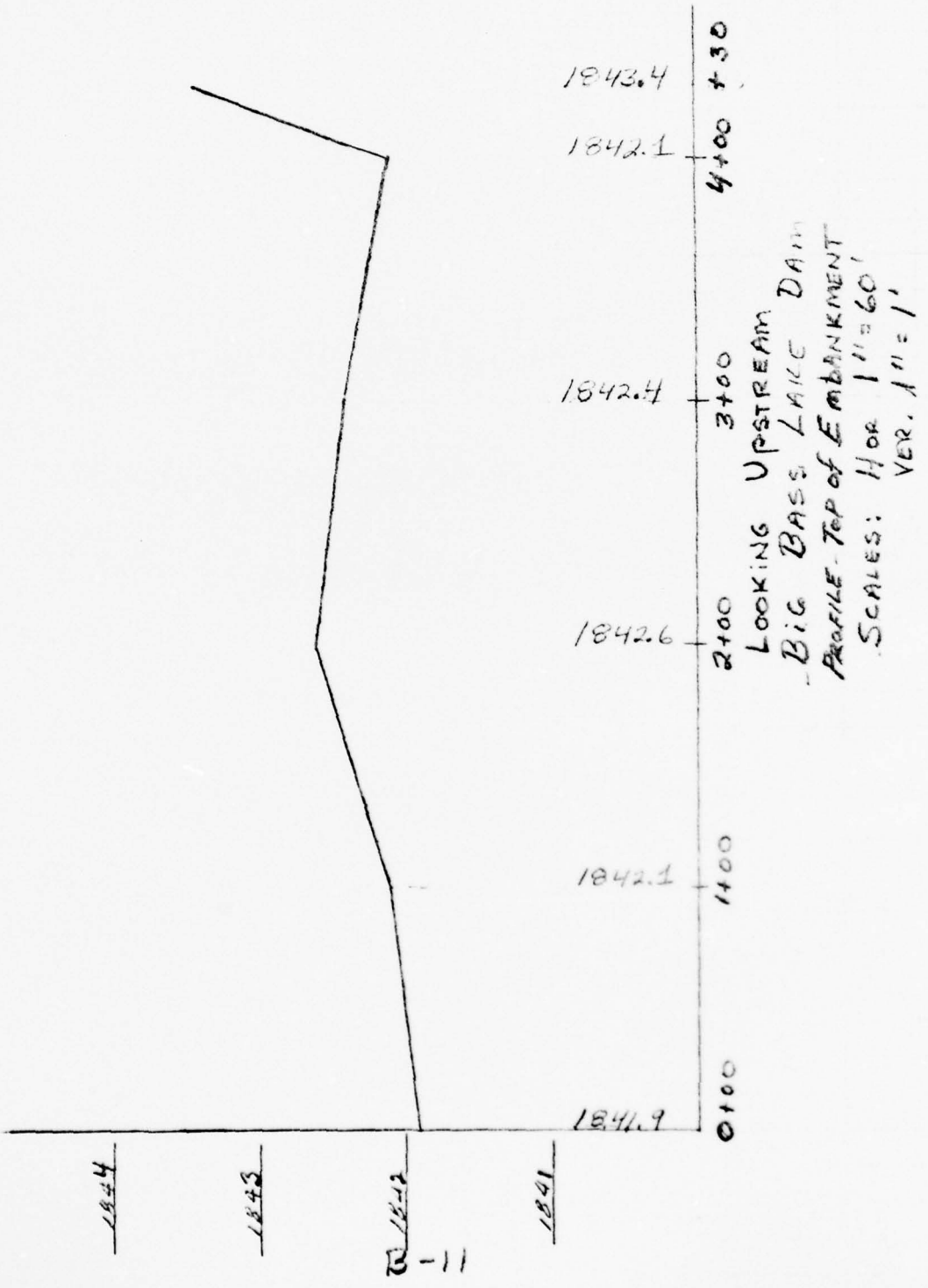
GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____

SHEET NO. ____ OF ____ SHEETS

FOR _____

COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



6513

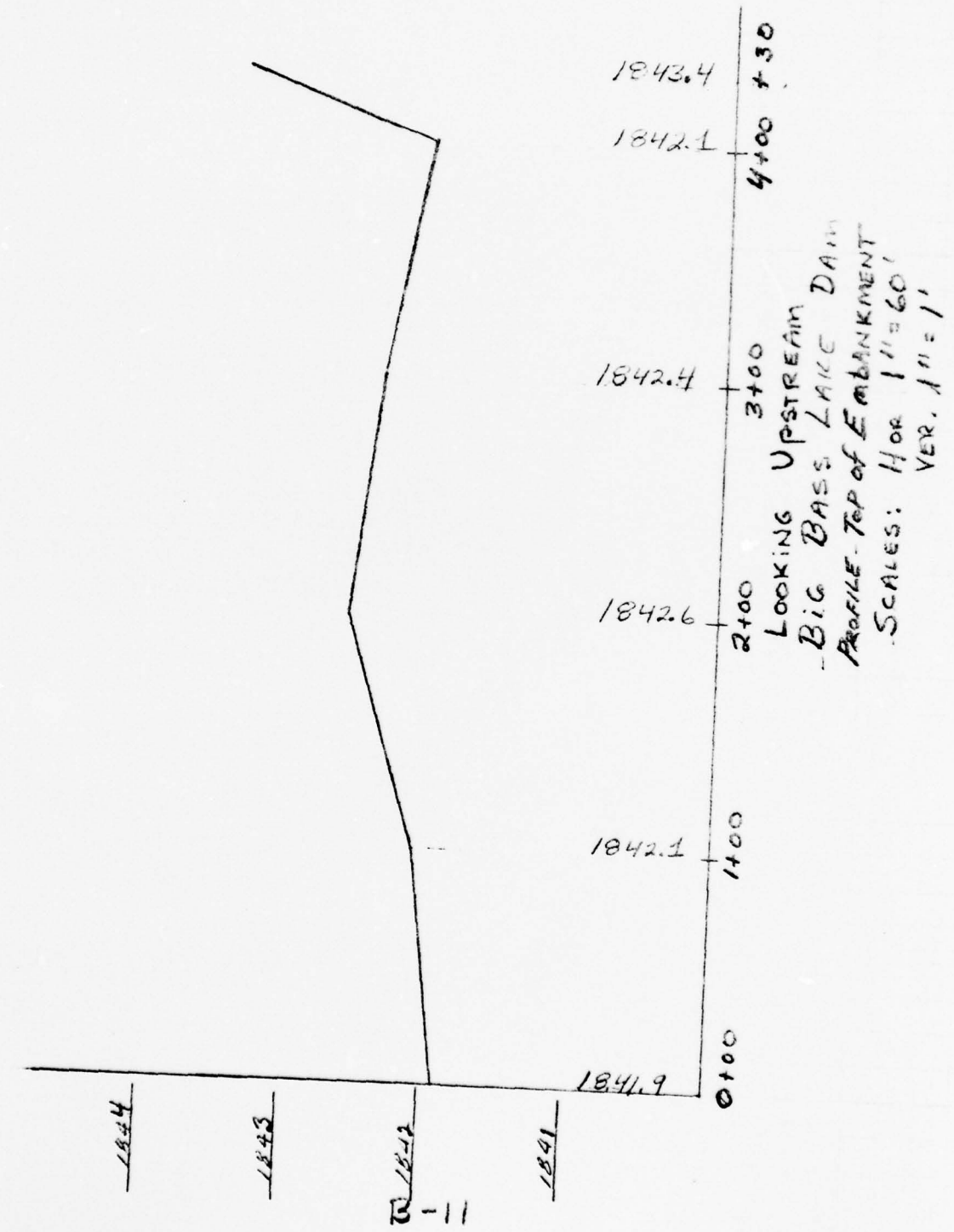
GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____

_____ SHEET NO. ____ OF ____ SHEETS

FOR _____

COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



6313

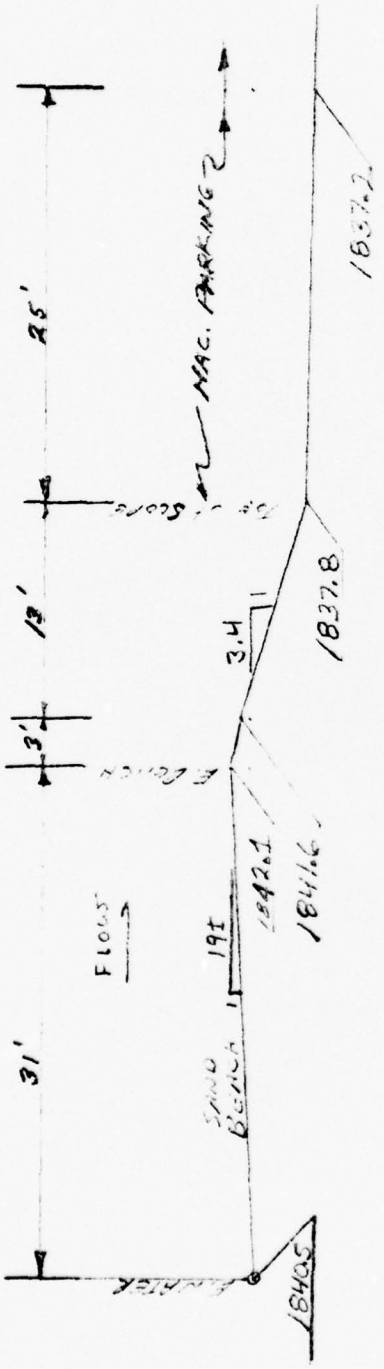
GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____

_____ SHEET NO. ____ OF ____ SHEETS

FOR _____

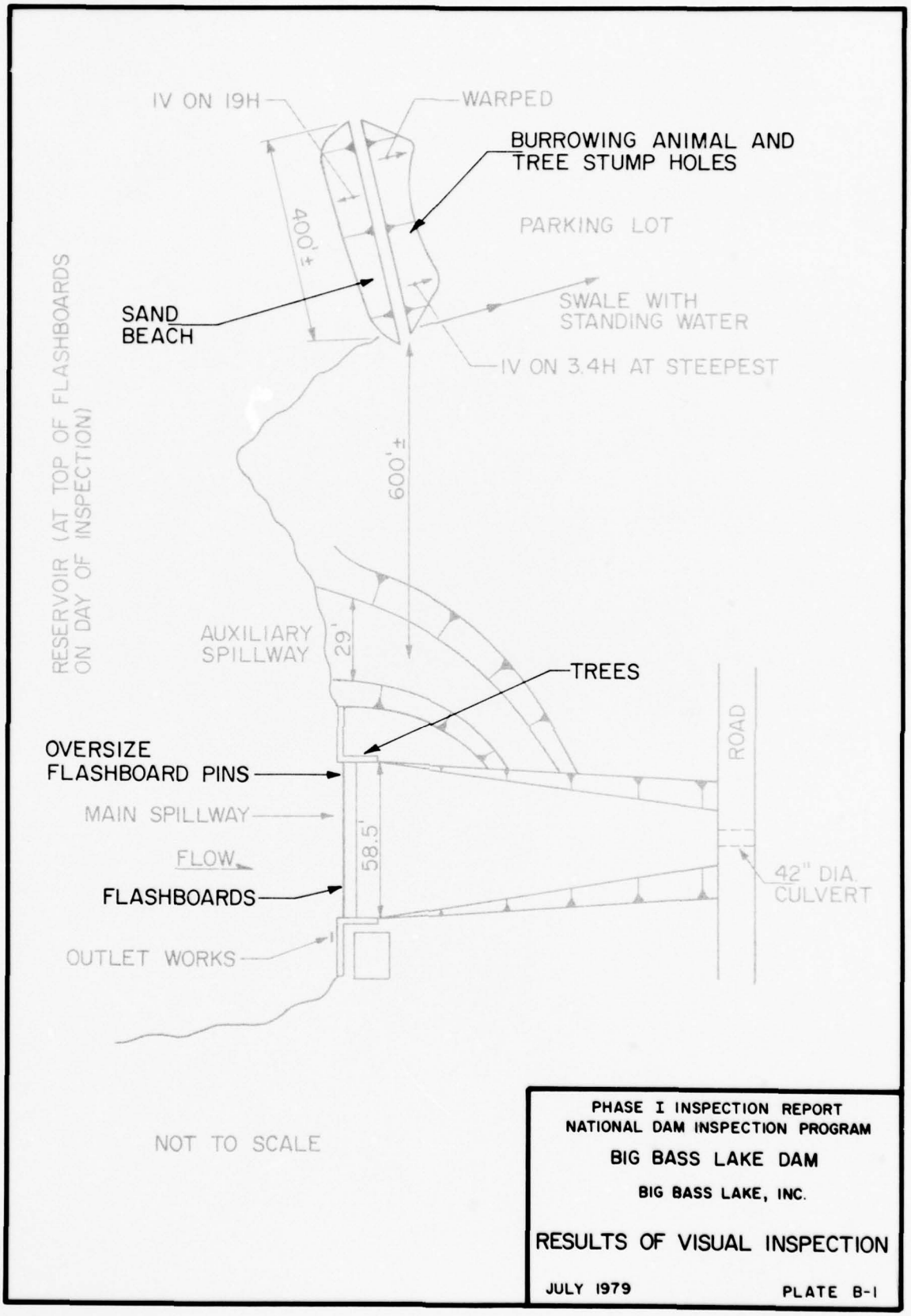
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



BIG BASS LAKE DAM
EMBANKMENT SECTION
- SCALE 1"=10'

B-12

8313



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BIG BASS LAKE DAM

BIG BASS LAKE, INC.

RESULTS OF VISUAL INSPECTION

JULY 1979 PLATE B-1

DELAWARE RIVER BASIN

TAMARACK CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

BIG BASS LAKE DAM

NDI ID No. PA-00368
DER ID No. 35-126

BIG BASS LAKE, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JULY 1979

APPENDIX C

HYDROLOGY AND HYDRAULICS

APPENDIX C

HYDROLOGY AND HYDRAULICS

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

APPENDIX C

DELAWARE River Basin

Name of Stream: TRIBUTARY CREEK

Name of Dam: BIG BASS LAKE

NDI ID No.: PA - 00368

DER ID No.: 35 - 126

Latitude: N 41° 15' 05" Longitude: W 75° 29' 45"

Top of Dam (~~low spot~~) Elevation: 1842.5 (EMBANKMENT)

Streambed Elevation: 1830.4 (AT SPILLWAY) Height of Dam: 12 ft

Reservoir Storage at Top of Dam Elevation: 454 acre-ft

Size Category: SMALL

Hazard Category: HIGH (see Section 5)

Spillway Design Flood: VARIES 1/2 PMF TO PMF
BECAUSE OF DOWNSTREAM POPULATION USE PMF

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
NONE				

DOWNSTREAM DAMS

NONE				

DELAWARE River Basin

Name of Stream: TANNERS CREEK

Name of Dam: BIG BASS LAKE

~~NDS ID No.~~: _____

~~DER ID No.~~: _____

Latitude: N 41° 15' 05" Longitude: W 75° 29' 45"

DETERMINATION OF PMF RAINFALL

For Area A

which consists of Subareas A1 of 1.75 sq. mile

_____ _____

_____ _____

_____ _____

_____ _____

Total Drainage Area 1.75 sq. mile

PMF Rainfall Index = 23.1 in., 24 hr., 200 sq. mile

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone	N/A	1
Geographic Adjustment Factor	_____	1.0
Revised Index Rainfall	_____	N/A

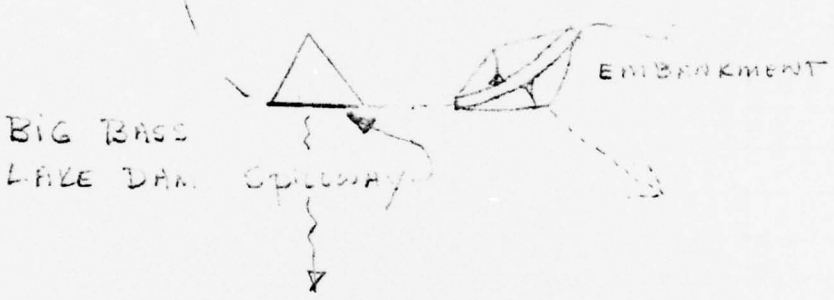
RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	111
12 hours	123
24 hours	133
48 hours	142
72 hours	N/A
96 hours	N/A

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
_____ SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SUBAREA A-1



FOR LOCATION OF
downstream SECTIONS
SEE PLATE C-1

SKETCH
OF
SYSTEM

C-4

0313

Data for Dam at Outlet of Subarea A1
(see Sketch on Sheet C-__)

Name of Dam: BIG BASS LAKE

Height: 12 (existing)

Spillway Data:	Existing Conditions	Design Conditions
Top of Dam Elevation	1841.9	1842.5
Spillway Crest Elevation	SEE	NEXT SHEET
Spillway Head Available (ft)		
Type Spillway	SEE NEXT SHEET	
"C" Value - Spillway		
Crest Length - Spillway (ft)		
Spillway Peak Discharge (cfs)		
Auxiliary Spillway Crest Elevation		
Auxiliary Spillway Head Available (ft)		
Type Auxiliary Spillway	GRASSED CHANNEL	
"C" Value - Auxiliary Spillway		
Crest Length - Auxiliary Spillway (ft)	SEE NEXT SHEETS	
Auxiliary Spillway Peak Discharge (cfs)		
Combined Spillway Discharge (cfs)		

Spillway Rating Curve: ON FOLLOWING SHEETS

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)

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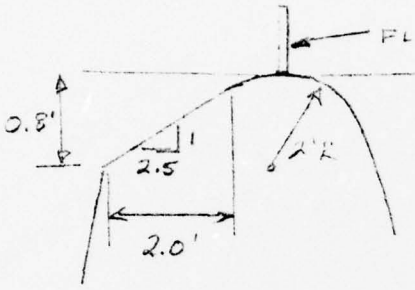
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

BIG BASS LAKE

MAIN SPILLWAY



REFERENCE KING
HANDBOOK OF HYDRAULICS
SECT 5
FIG. 75 & FIG 72

TABLE OF C VALUES

H		
0.5	3.18	—
1.	3.30	3.38
1.5	3.37	3.46
2.	3.42	3.51
2.5	3.46	3.55
3	3.49	3.58
3.5	3.52	3.62
4.	3.54	3.68
4.5	—	3.74
5	—	3.83

USE

H	C
1	3.35
2	3.45
3	3.55
4	3.60
5	3.80
>5	3.80

FOR FLASHBOARDS
USE C = 3.1

6313

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

MAIN SPILLWAY RATING

TABLE OF DISCHARGES $Q = CLH^{3/2}$

$L = 58.5'$

POOL ELEV	FLASHBOARDS AS DESIGNED CFS		NO. FLASHBOARDS CFS	FLASHBOARDS REMAIN INTACT CFS
1839.4	0	}	0	0
1840.4	0		196	0
1840.5	0	FLASHBOARDS	226	0
1841.4	155	} INTACT	571	155
1841.5	614	←	614	181
1841.6	662	←	662	209
1842.4	1079	←	1079	475
1843.4	1689	←	1689	896
1843.5	1758	←	1758	942
1844.4	2485	←	2485	1397
1848.4	6002	←	6002	4027

NOTE: ORIGINAL SPILLWAY DESIGN HAD CREST AT EL 1838.4; IT WAS CONSTRUCTED AT 1839.4

8513

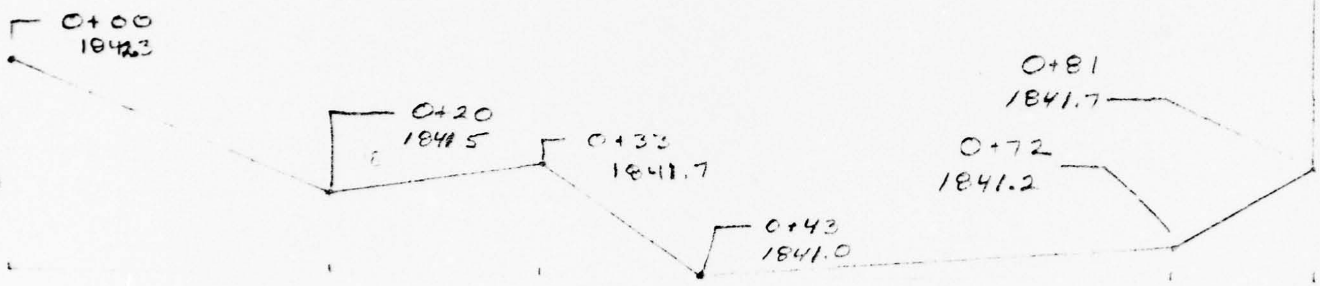
GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT ______ FILE NO. ______
______ SHEET NO. ______ OF ______ SHEETS
FOR ______
COMPUTED BY ______ DATE ______ CHECKED BY ______ DATE ______

AUXILIARY SPILLWAY AT CREST

USING CRITICAL DEPTH = $\frac{2.7}{3.1}\sqrt{\frac{A^3 g}{T}}$

POOL = hV + WATER SURFACE $hv = V^2/2g$ $V = Q/A$



WATER SURFACE	T	ΔA	A	Q	hv	POOL
1841.0	0			0		1841.0
1841.2	29	2.9	2.9	5	NEGL	1841.2
1841.5	41	10.5	13.4	38	.1	1841.6
1841.7	66	1.8 + 8.9	24.1	72	.1	1841.8
1842.3	81	44.1	68.2	355	.4	1842.7
1843.5	81	97.2	141.3	922	.7	1844.2
1846.0	81	202.5	343.8	3500	1.6	1847.6

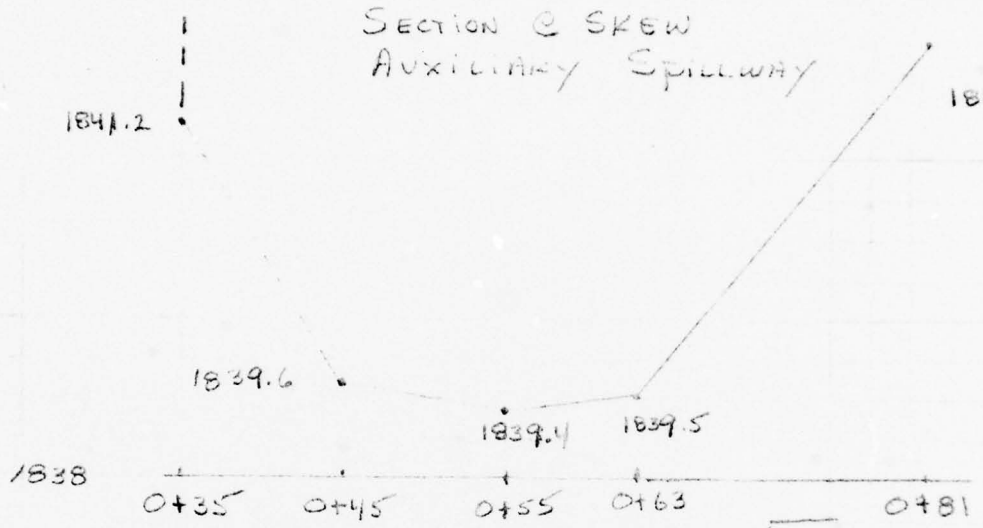
8315

0313

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SECTION @ SKEW
AUXILIARY SPILLWAY



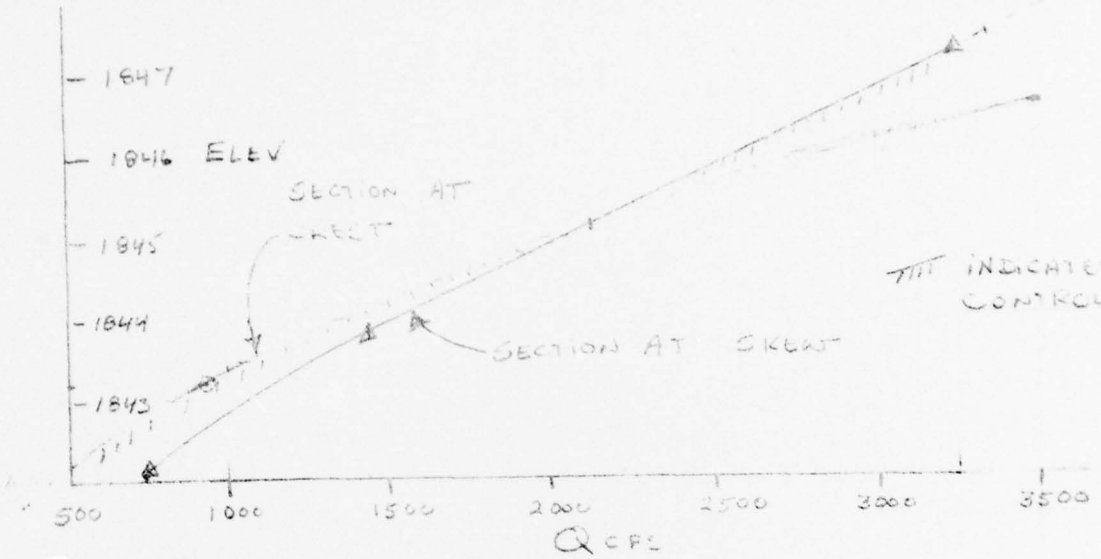
CRITICAL depth $Q = \frac{2.7}{3.1}\sqrt{\frac{A^3}{T}}$

W.S	T	ΔA	A	Q	hv	Pool
1839.4	0		0	0		1839.4
		.6				
1839.5	12.5		.6	—		N/A
		1.5				
1839.6	18		2.1	—		N/A
		8.6				
1840.0	25		10.7	35	.2	1840.2
		40.2				
1841.2	42		50.9	277	.6	1841.8
		22				
1841.7	46		72.9	453	.6	1842.3
		27.6				
1842.3	46		100.5	734	.8	1843.1
		55.2				
1843.5	46		155.7	1415	1.3	1844.8
		115				
1846.0	46		270.7	3244	2.2	1848.2

0313

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA

SUBJECT _____ FILE NO. _____
SHEET NO. _____ OF _____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



CHECK ON HYDRAULIC CONTROL
Σ MAIN & AUX. SPILLWAY DISCH

POOL ELEV	AUX SP. DISCH.	FLASHBOARDS AS DESIGNED	NO FLASHBOARDS	FLASHBOARDS REMAIN INTACT
1839.4	0	0	0	0
1840.5	0	0	226	0
1841.0	0	64	404	155
1841.4	22	179	593	177
1841.5	30	644	644	211
1842.4	261	1340	1340	736
1843.4	620	2309	2301	1516
1844.4	1074	3559	3551	2471
1848.4	3350	9352	9352	7377

SEE SECTION 5 USGL

Data for Dam at Outlet of Subarea A1

Name of Dam: BIG [illegible] LAKE

Outlet Works Rating:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	1832.9		
Invert of Inlet	1832.9		
Type	CMP		
Diameter (ft) = D	1.5		
Length (ft) = L	7.7		
Area (sq. ft) = A	1.77		
N	.024 (CHOW)		
K Entrance	0.5		
K Exit	1.0		
K Friction* = $29.1_N{}^2 L/R^{4/3}$	.48		
Sum of K	1.98		
$(1/K)^{0.5} = C$	0.71		
Maximum Head (ft) = HM	9.6		
$Q = C A \sqrt{2g(HM)}$ (cfs)	31		
Q Combined (cfs)	≈ 30		

* R = Hydraulic Radius = (Area/Wetted Perimeter) = D/4 for Circular Conduits.

8313

Data for Dam at Outlet of Subarea A1

Name of Dam: BIG [illegible] LAKE

Storage Data:

Elevation	Area (acres)	Storage million gals	Storage acre-ft	Remarks
1829.3 = ELEVO*	0	0	0	
1838.4 = ELEV1	42 = A1	41.6	128 = S1	DESIGN CREST
1839.4	79		188	ACTUAL CREST
1840.0	82		236	
1840.5	84		277	TOP FLASHBOARD
1842.5	94		455	
1860	204			
**				

* ELEVO = ELEV1 - $(3S_1/A_1)$

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at ~~Top of Dam~~ 1840.5 is 7 percent of watershed.

Remarks: _____

RESULTS OF VISUAL INSPECTION

JULY 1979 PLATE B-1

DELAWARE River Basin

Name of Stream: TRIBUTARY [illegible]

Name of Dam: BIG BOG LAKE

~~NDS ID No.~~: _____

~~DER ID No.~~: _____

Latitude: N 41° 15' 05" Longitude: W 75° 29' 45"

Drainage Area: 1.75 sq. mile

Data for Subarea: #1 (see Sketch on Sheet C-4)

Name of Dam at Outlet of Subarea: BIG BOG LAKE

Drainage Area of Subarea: 1.75 sq. mile

Subarea Characteristics:

Assumed Losses: 1.0-inch initial abstraction + 0.05 in/hr

The following are measured from outlet of subarea to the point noted:

L = Length of Main Watercourse extended to the divide = 2.35 mile

L_{CA} = Length of Main Watercourse to the centroid = 1.03 mile

From NAB Data: AREA 2 POINTS B

Cp = 0.45

C_T = 2.1

$Tp = C_T \times (L \times L_{CA})^{0.3}$ = 2.74 (hrs)

Flow at Start of Storm = 1.5 cfs/sq. mile x Subarea D.A = 2.6 cfs

Computer Data:

QRCSN = -0.05 (5% of peak flow)

RTIOR = 2.0

Remarks: _____

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT BIG BASS LAKE DAM FILE NO.
SHEET NO. OF SHEETS
FOR NATIONAL DAM INSPECTION PROGRAM
COMPUTED BY DATE CHECKED BY DATE

Assumptions for Breach Analysis

Based on the results of the stability analyses, it appears that the main spillway could fail by overturning due to excessive toe pressures. The analyses indicate that failure could occur at a pool level somewhat above the flashboard crest elevation. The following assumptions will be used in evaluating the effect of an overturning failure:

1. Magnitude of flood = 20% PMF
2. Failure occurs by overturning when pool elevation is 0.3 feet higher than spillway walls.
3. Entire section overturns in a brief period of time (use t = 0.1 hour)

6313

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____

SHEET NO. ____ OF ____ SHEETS

FOR _____

COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SELECTED COMPUTER OUTPUT INDEX

NOTE: PLAN 1 ASSUMES NO FAILURE.
PLAN 2 IS WITH FAILURE

```
**************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION        JULY 1978
  LAST MODIFICATION   26 FEB 79
**************************************

A1                  NATIONAL DAM INSPECTION PROGRAM
A2                          TAMARACK CREEK
A3                          BIG BASS LAKE DAM
B      300       0      15       0       0       0       0       0       0       0
B1       5                                                              -4
J        1       6       1
J1       1      .5      .4      .3      .2      .1
K        0       1                                       1
K1         RUNOFF INTO BIG BASS LAKE DAM
M        1       1    1.75            1.75                               1
P             23.1     111     123     133     142
T                                                      1.0     .05             .07
W     2.74    0.45
X     -1.5   -0.05     2.0
K        1       1                                       1
K1         ROUTE THROUGH LAKE(FLASHBOARDS REMAIN INTACT)
Y                                1
Y1       1                                          -1840.5     -1
Y41840.5      1841  1841.5  1842.4  1843.4  1844.4  1848.4
Y5       0     155     211     736    1516    2471    7377
$A       0      42      79      82     204
$E1829.3  1838.4  1839.4    1840    1860
$$1840.5
$D1841.2
$L       1       4       5      24      60     164     393     474     474
$V1841.2  1841.4  1841.5  1841.7  1841.9  1842.1  1842.4  1842.6    1850
K       99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 1.00	RATIO 2 .50	RATIO APPLIED TO FLOWS RATIO 3 .40	RATIO 4 .30	RATIO 5 .20	RATIO 6 .10
HYDROGRAPH AT	1	1.75	1	3027.	1513.	1211.	908.	605.	303.
	(	4.53)	(	85.70)(	42.85)(	34.28)(	25.71)(	17.14)(	8.57)(
ROUTED TO	1	1.75	1	2269.	1445.	1117.	776.	459.	183.
	(	4.53)	(	64.08)(	40.93)(	31.64)(	21.98)(	13.00)(	5.19)(

C-16

72 hours
96 hours

C-3

N/A
N/A

BIG BASS LAKE DAM

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1840.50	1840.50	1841.20
STORAGE	277.	277.	327.
OUTFLOW	0.	0.	177.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1843.21	2.01	526.	2969.	23.50	43.00	0.00
.50	1842.64	1.44	469.	1445.	18.75	43.25	0.00
.40	1842.49	1.29	454.	1117.	17.00	43.50	0.00
.30	1842.25	1.05	432.	776.	15.25	44.00	0.00
.20	1841.89	.69	397.	459.	12.25	44.75	0.00
.10	1841.25	.05	342.	183.	3.50	45.75	0.00

C-17

C-4

```
**************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  26 FEB 79
**************************************
A1                              NATIONAL DAM INSPECTION PROGRAM
A2                                       TAMARACK CREEK
A3                                       BIG BASS LAKE DAM
B      300       0       6       0       0       0       0       0      -4       0
B1       5                                                              -4
J        2       1       1
J1      .2
K        0       1                                       1
K1       RUNOFF INTO BIG BASS LAKE DAM
M        1       1    1.75            1.75                               1
P             23.1     111     123     133
T                                                      1.0     .05             .07
W     2.74    0.45
X     -1.5   -0.05     2.0
K        1       1                                       1
K1       ROUTE THROUGH LAKE(FLASHBOARDS REMAIN INTACT)
Y                                1       1
Y1       1                                         -1840.5      -1
Y41840.5      1841  1841.5  1842.4  1843.4  1844.4  1848.4
Y5       0     155     211     736    1516    2471    7377
$A       0      42      79      82     204
$E1829.3  1838.4  1839.4    1840    1860
$$1840.5
$D1841.2
$L       1       4       5      24      60     164     393     474     474
$V1841.2  1841.4  1841.5  1841.7  1841.9  1842.1  1842.4  1842.6    1850
$B    58.5       0  1830.4      .1  1840.5    1850
$B    58.5       0  1830.4      .1  1840.5  1841.8
K        1       2                                       1
K1       ROUTINGSECTION
Y                                1       1
Y1       1                                              -1
Y6     .09     .07     .09    1804    1830    1500   .0067
Y7       0    1860       0    1840     220    1820     245    1804     295    1804
Y7     320    1820     550    1840     780    1860
K        1       3                                       1
K1       DAMAGE CENTER
Y                                1       1
Y1       1                                              -1
Y6     .09     .07     .09    1798    1820     400    .011
Y7       0    1840     150    1820     500    1800     600    1798     700    1798
Y7     900    1800     980    1820     990    1840
K       99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .20
HYDROGRAPH AT	1	1.75	1	603.
	(	4.53)	(	17.07)(
			2	603.
			(	17.07)(
ROUTED TO	1	1.75	1	453.
	(	4.53)	(	12.84)(
			2	6960.
			(	197.10)(
ROUTED TO	2	1.75	1	453.
	(	4.53)	(	12.83)(
			2	6950.
			(	196.79)(
ROUTED TO	3	1.75	1	453.
	(	4.53)	(	12.83)(
			2	6612.
			(	187.22)(

RATIOS APPLIED TO FLOWS

C-19

SUMMARY OF DAM SAFETY ANALYSIS

BIG BASS LAKE DAM

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1840.50	1840.50	1841.20
STORAGE	277.	277.	337.
OUTFLOW	0.	0.	177.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	1841.88	.68	328.	453.	10.40	20.60	0.00

PLAN 2 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1840.50	1840.50	1841.20
STORAGE	277.	277.	337.
OUTFLOW	0.	0.	177.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	1841.80	.60	391.	6960.	2.26	19.50	19.40

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	453.	1806.7	20.70

PLAN 2 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	6950.	1816.9	19.60

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	453.	1799.2	20.80

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	6612.	1802.0	19.60

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SUMMARY OF PERTINENT RESULTS

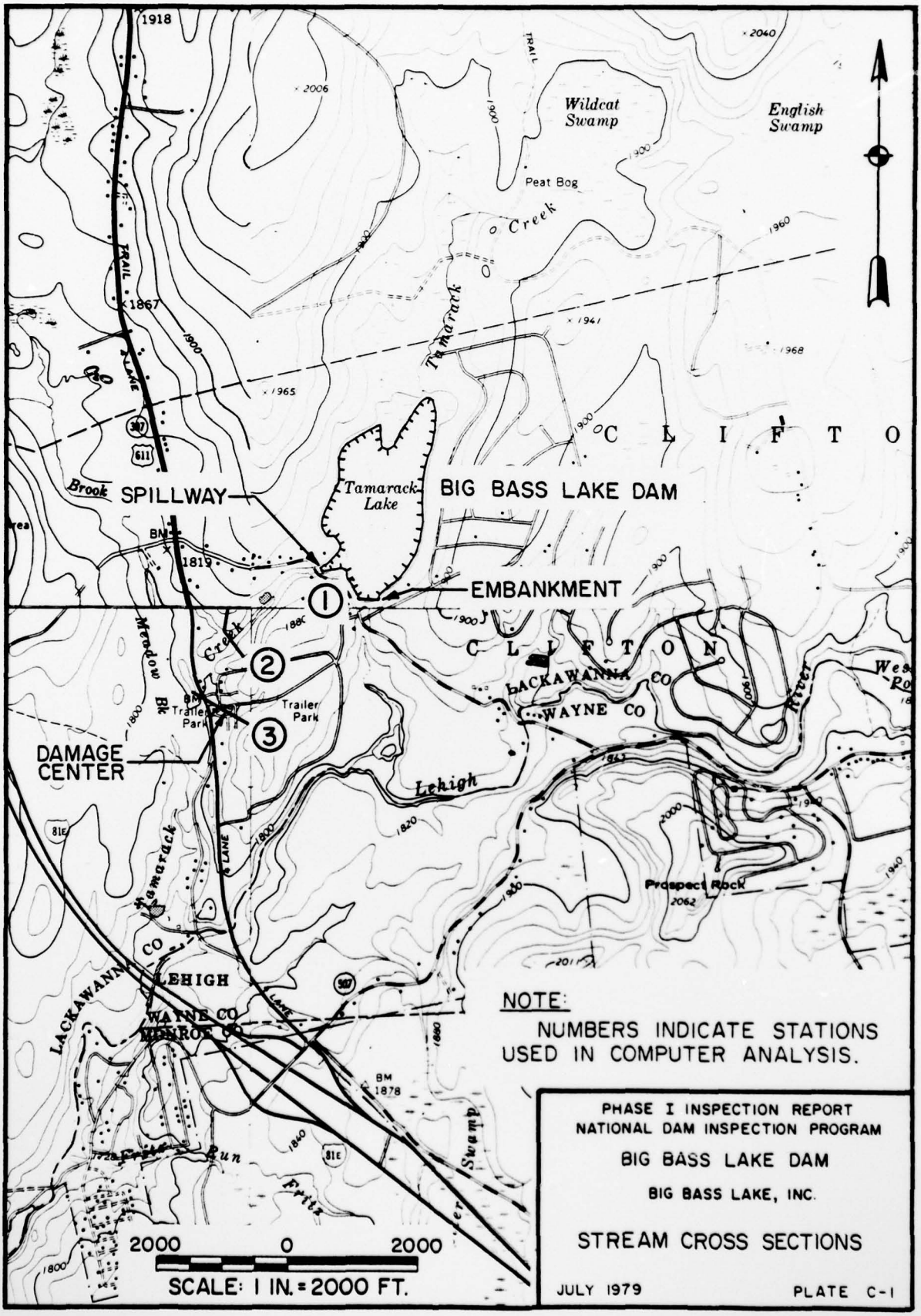
PMF RAINFALL = 26.24"

	PMF	½ PMF
RUNOFF (INCHES)	24.01	12.0
PEAK INFLOW (CFS)	3027	1513
PEAK OUTFLOW (CFS)	2969	1445
DEPTH OVERTOPPING* (FT)	2.01	1.44
DURATION OVERTOPPING (HRS)	23.50	18.75

* LOW AREA by MAIN SPILLWAY

BREACH ANALYSIS 20% PMF AT MAIN SPILLWAY

	NO FAILURE PLAN 1	FAILURE PLAN 2
PEAK OUTFLOW (CFS)	453	6960
WATER SURFACE AT DAMAGE CENTER (ELEVATION)	1799.2	1802.0


SPILLWAY
BIG BASS LAKE DAM
EMBANKMENT
DAMAGE CENTER
Tamarack Lake
Wildcat Swamp
English Swamp
Peat Bog
Tamarack Creek
Meadow Brook Creek
Trailer Park
Lehigh River
Prospect Rock
CLIFTON
LACKAWANNA CO
WAYNE CO
LEHIGH
MONROE CO
NOTE:
NUMBERS INDICATE STATIONS USED IN COMPUTER ANALYSIS.
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
BIG BASS LAKE DAM
BIG BASS LAKE, INC.
STREAM CROSS SECTIONS
JULY 1979
PLATE C-1

DELAWARE RIVER BASIN

TAMARACK CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

BIG BASS LAKE DAM

NDI ID No. PA-00368
DER ID No. 35-126

BIG BASS LAKE, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JULY 1979

APPENDIX D

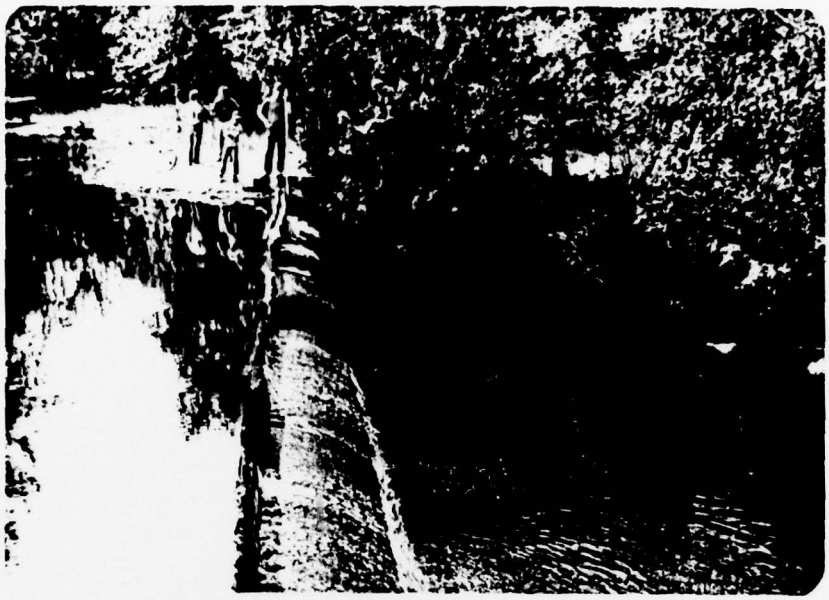
PHOTOGRAPHS

A. Embankment

B. Left Abutment of Embankment

C. Burrowing Animal and Stump Hole in Embankment

D. Main Spillway and Outlet Works



E. Main Spillway and Auxiliary Spillway Approach Channel

F. Auxiliary Spillway Crest

DELAWARE RIVER BASIN

TAMARACK CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

BIG BASS LAKE DAM

NDI ID No. PA-00368
DER ID No. 35-126

BIG BASS LAKE, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JULY 1979

APPENDIX E

GEOLOGY

BIG BASS LAKE DAM

APPENDIX E

GEOLOGY

1. General Geology. The damsite and reservoir are located in Lackawanna County. Lackawanna County was completely covered with ice during the last continental glaciation of Pleistocene time. The general direction of ice movement was S 35° -40° W. Glacial drift covers the entire County, except where subsequent erosion has removed it. Thick deposits of glacial outwash occur in many places along the Lackawanna River, and are 50 to 100 feet thick near Dickson, Scranton, and Moosic.

The only important structural feature in Lackawanna County is the Lackawanna Syncline, which traverses the County in a southwesterly direction. The syncline enters the County at the northeast corner as a narrow shallow trough, gradually deepens and broadens toward the southwest, and reaches its maximum development in Luzerne County. The rock formations exposed range from the post-Pottsville formations (youngest) through the Pottsville, Mauch Chunk shale, Pocono sandstone to the Damascus formation of the Catskill group (oldest). The rim rocks, the Pottsville formation and Pocono sandstone, have dips that rarely exceed 10° to 20° and form a rather simple syncline. The core rocks, the post-Pottsville formations, are folded into a series of minor anticlines and synclines which trend about N 70° E. The rocks in the northwestern and southeastern parts of the County, outside of the limits of the Lackawanna Syncline, are generally horizontally stratified.

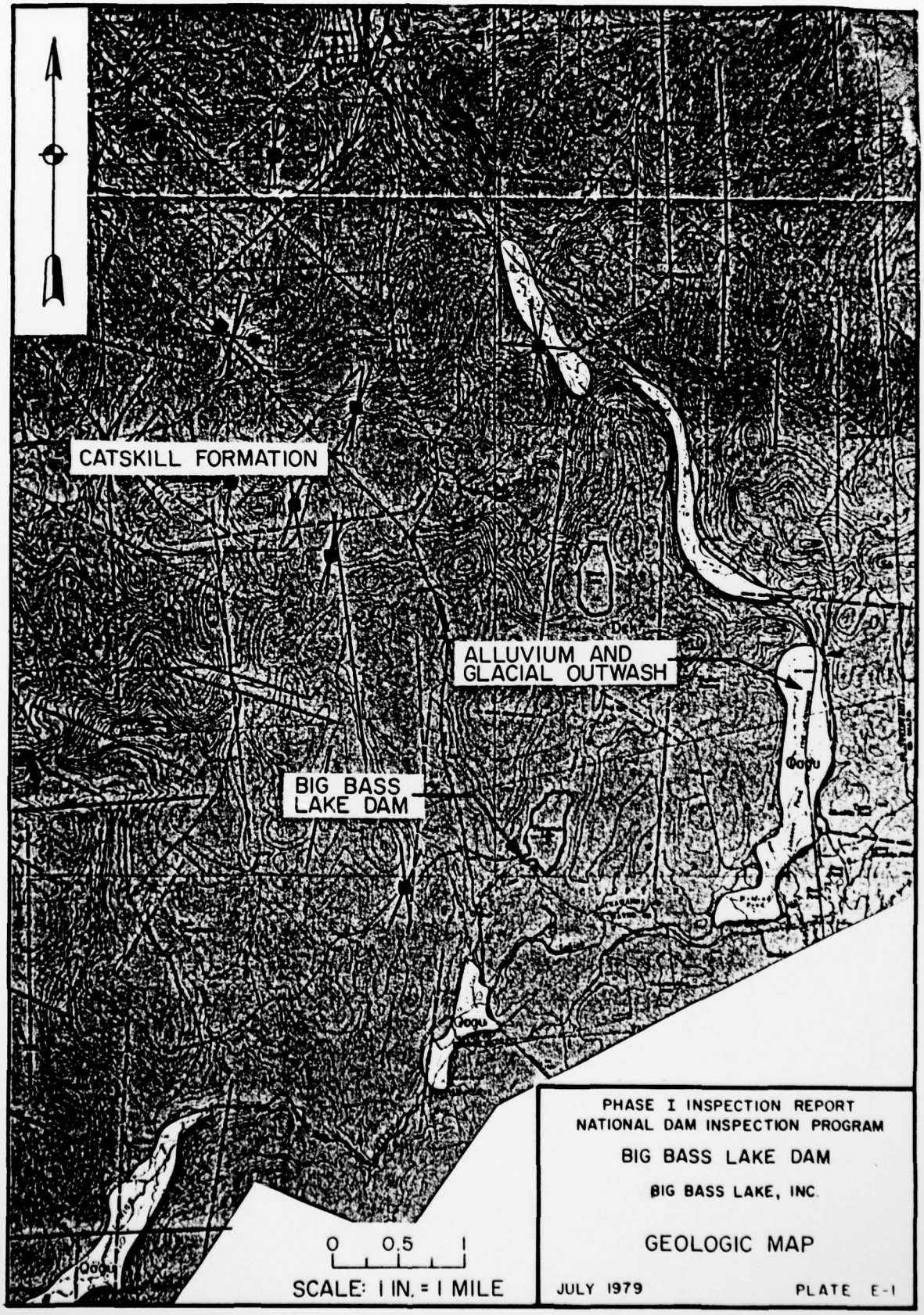
The Lackawanna River, in general, follows the axis of the Lackawanna Syncline. Southeast of the Lackawanna River, the rise in terrain is quite gradual and the crests of the high mountains are several miles from the Lackawanna River. Streams, such as Roaring Brook, Stafford Meadow Brook, and Spring Brook, have cut deep canyons through the mountains and follow a tortuous course to their confluence with the Lackawanna River near Scranton, Pennsylvania. Northwest of Lackawanna River, the mountains rise abruptly to a sharp ridge which in most places is somewhat higher than the country to the northwest. Consequently, most of the drainage in this part of the county flows westward by way of Tunkhannock Creek. A few small tributary streams, however, such as Leggetts Creek, flow eastward from this

area into the Lackawanna Rvier. In the area of interest, the Lackawanna River streambed is founded in post-Pottsville formations. Proceeding uphill from the river, the older Pottsville formation, Mauch Chunk shale, Pocono sandstone, and Catskill continental group are encountered in turn. The tributary streams, in flowing down the mountains, have generally cut through or around the hard sandstone and conglomerate members, and have eroded their streambed into the softer shales and glacial till. The Catskill continental group of rocks underlies the greater part of Lackawanna County.

2. Site Geology. Big Bass Lake Dam is underlain by the Catskill formation of late Devonian Age on the Pocono Plateau. The plateau in this area is of very moderate local relief with many swamps. The Catskill formation is composed of dark red shale, claystone, and siltstone; gray fine to medium grained sandstone, and coarse grained conglomerates. Crossbedding, channeling, and cut-and-fill features are common to the sandstone and conglomerate units. Siltstone predominates in the lower part of the formation. A report in the PennDER files, dated 1951, states that:

> "A test pit 4 feet deep located where the footing for the masonry dam is to be in-dicated the foundation material to be essentially a light gray clay intermixed with rocks and boulders. This soil is satisfactory for the footing to rest on. Although the owner had started to build up the embankment for the earth dam made by a low point in the terrain, the material under the dam and of which most of the dam will consist is essentially a dark gray clay".

The engineering properties of this clay are not known.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BIG BASS LAKE DAM

BIG BASS LAKE, INC.

GEOLOGIC MAP

JULY 1979

PLATE E-1